

Geothermal Progress Monitor

6

Progress Report

June 1982ORIGINAL
COMPLETED

148

**U.S. Department of Energy**Assistant Secretary for Conservation
and Renewable Energy
Division of Geothermal Energy

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GEOHERMAL PROGRESS MONITOR
REPORT NO. 6
June 1982

U.S. Department of Energy
Assistant Secretary for Conservation
and Renewable Energy
Division of Geothermal Energy
Washington, D.C. 20461

Prepared in Cooperation With the
Interagency Geothermal Coordinating Council
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PREFACE

The Geothermal Progress Monitor Report is published periodically and disseminated within the federal government and to major DOE contractors and others who need current information on geothermal energy development. The report provides information on status changes and the overall rate of progress in the development of U.S. geothermal resources. These changes are reported to and observed by the Geothermal Progress Monitor (GPM) System.

The primary purpose of the GPM System is to monitor and report activities in the geothermal industry in order to assist the Division of Geothermal Energy and other member agencies of the Interagency Geothermal Coordinating Council (IGCC) in determining R&D priorities.

The principal objectives of the GPM System are to:

- 1) provide a single point of reference on a national basis for the status of the various geothermal activities, especially R&D directed at solution of recognized technical problems;
- 2) identify significant trends in these activities; and
- 3) report events that may have significant impact on the course of these activities.

The reports focus on two types of information:

- Status - the baseline of how much energy is being produced from geothermal sources and the level of activity being pursued to increase production.
- Trends - changes that occur with respect to the baseline information and the possible significance in each report.

Each of these types of information is addressed, as appropriate, in the separate subject sections listed in the Table of Contents, with the Executive Summary providing a quick highlighting of the new information in each report.

The overall objective of this report is usefulness. The only way to determine its usefulness is by response from its recipients and users. Therefore comments on any aspect of the contents or presentation are encouraged. All comments and contributions will be given serious consideration, even though staff or schedule limitations may preclude their immediate incorporation into the current report. For any contributions, please include a name and address or phone number for follow-up or further information.

These GPM Reports are part of an interactive process, whereby contributions from DOE Headquarters and the field will shape the contents of the reports. Continuing input is needed regarding types of information or analyses that would be of use to recipients.

All IGCC participants are requested to submit items of interest, particularly:

- 1) changes in policy or regulations, both final and pending;
- 2) important events in the field, with a comment on the possible significance of the event; and
- 3) brief data summaries or statistics that may clarify status or indicate trends.

All comments or contributions are welcome. Please address them to:

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FOREWORD

Geothermal Progress Monitor Report No. 6 presents a state-by-state summary of the status of geothermal leasing, exploration, and development in major physiographic regions where geothermal resource potential has been identified. Recent state-specific activities are reported at the end of each state status report, while recent activities of a more general nature are summarized briefly in Part II of the report. The report also includes a list of recent publications of potential interest to the geothermal community and a directory of contributors to the geothermal progress monitoring system.

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I. STATE STATUS SUMMARIES

This section is a state-by-state summary of the status of geothermal leasing, exploration, and development in major physiographic regions where significant geothermal resource potential has been identified.

For the purposes of this summary, resource potential is based on criteria of measured temperature, depth of existing producible wells, and existence of significant electric power or direct heat development. The sites surveyed in this report were selected according to one or more of the following criteria:

- estimated reservoir temperature of 150°C or higher;
- existence of one or more producible deep (2000 feet or greater) geothermal wells; and
- significant potential for direct heat applications, as evidenced by existing projects or interest shown by prospective users in developing such applications.

Each of the sixteen state summaries consists of a general overview of the state with a map showing the locations of identified geothermal resource areas within the boundaries of specific physiographic regions; status tables showing leasing, exploration and development activities; and a narrative section detailing status information outlined in the tables. Each state summary concludes with a list of recent activities or actions of statewide interest. Recent activities of a more general nature are summarized briefly in Part II of this report.

The first table of each state section presents federal lands leasing and exploration which have taken place in each of the major regions. Leases are shown as acreage held by each company involved in geothermal activities in a given region and by private individuals in the aggregate. Deep wells are defined as those wells of greater than 2000 feet in depth. Though each region identified in the tables is broken down into sites or areas, developers' leased acreage or drilled wells generally reflect regional rather than site-specific activity.

The second table presents actual development activity, if any, which has taken place in a region. Development activity refers to power plants or direct heat projects which are in operation, under construction, or proposed, including those which are in the feasibility study stage. Real or projected dates for project operation are shown in the last column. For electric power plants, the utility which will buy the geothermal power from the field developer is indicated. In the case of California, electric power development at The Geysers is shown in a third and separate table.

ALASKA

Alaska's low and moderate temperature geothermal resources are being used in a few direct heat applications. The Alaska legislature recently passed a law defining geothermal resources.

Leasing and Exploration

Four areas in Alaska have been identified as having significant geothermal resource potential. The locations of these areas are shown in the map in Figure 1. There are no federal leases and no completed, deep producible wells in these areas.

Direct Heat Applications

James Dykes of Bill Island Hot Springs has used geothermal energy for space and process heating applications since 1900. On Adak Island, a military base is pursuing a commercial district heating development. The project, which is receiving partial state funding, will extract geothermal energy from a 300°F reservoir. Direct use projects are detailed in Table 1.

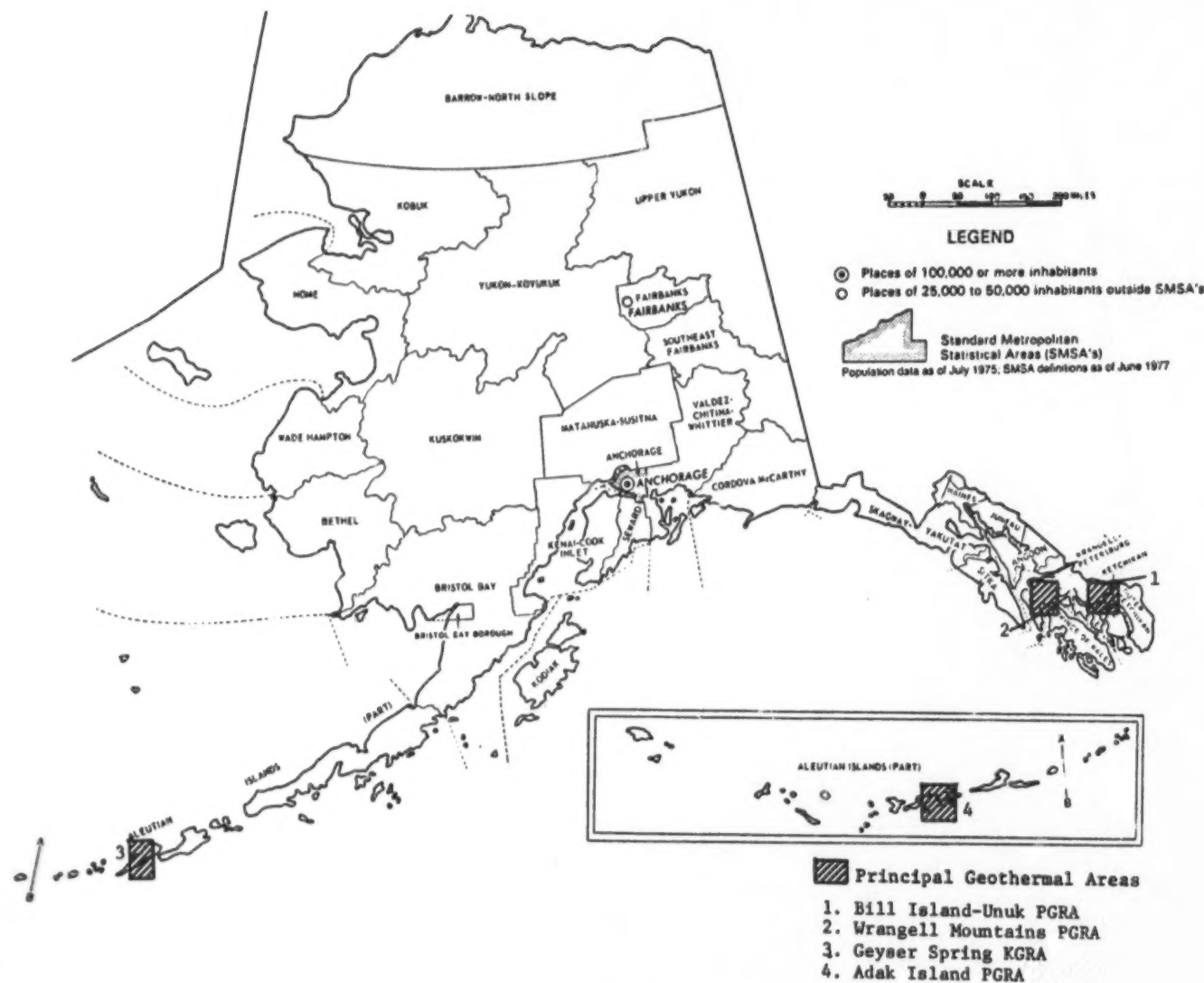
ARIZONA

The Arizona resource is in the low- to moderate-temperature range. The state is exploring ways to increase use of these resources; the state legislature is currently working on defining geothermal resources and thus improving their legal status.

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Principal Geothermal Resource Areas in Alaska

Figure 1



STATE: ALASKA

Code: UC[#] - Under Construction
 PR - Proposed
 OP - Operating
 U - Unknown

TABLE 1

ELECTRIC POWER AND DIRECT USE DEVELOPMENT ACTIVITY

REGION	AREAS/SITES INCLUDED	DEVELOPER	UTILITY	STATUS	MWe	ANNUAL BTU EQUIV (x 10 ⁹)	YEAR ON-LINE/ OPERATIONAL
ALEUTIAN	Adak Island PGRA	Military Base	-	PR	-	5*	U
COAST MOUNTAINS	Bill Island - Unuk PGRA/ Bailey Bay H.S.	James Dykes	-	OP	-	8	1900

*Annual energy use is a rough estimate.

#For direct heat projects, construction begins with preliminary development activities such as exploratory drilling.

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Leasing and Exploration

The three areas in Arizona which have been identified as having significant geothermal potential are shown in Figure 2. A total of three deep, producible wells have been completed in these areas and there are no active federal leases. More detailed information is given in Table 2.

Direct Heat Applications

Arizona's geothermal resources in the areas defined as having the greatest potential have not yet been used in heating projects, but exploratory drilling has begun at Williams Air Force Base near Chandler for a resource to heat and cool 40 buildings. An industrial process heat project is proposed for the same area. More information is shown in Table 3.

Recent Major Activities

- Legal Status of Geothermal Resources Needs Clarifying

Amendments to Arizona law concerning the use of ground water under 350°F are being considered by a legislative subcommittee working with the National Conference of State Legislatures (NCSL) and the Arizona State Geothermal Commercialization Team. According to the team, Arizona's new ground water act needs to be amended to clarify the difference between a geothermal resource and a ground water resource. Hot water at temperatures below 350°F, suitable for direct heat applications, is available at many locations throughout the state but the law is not specific on how one would obtain permission to use this resource. The state law is not explicit on whether geothermal water is covered by the ground water act.

Source: GRC Bulletin, 4/81

- Williams Air Force Base, Arizona Considers Geothermal Direct Heat Use

Williams Air Force Base, situated near Chandler, Arizona may use geothermal energy to provide 3,320 tons of air conditioning for 40 non-residential buildings. The U.S. Air Force and Department of Energy are jointly funding exploratory well drilling at the base.

Source: Phoenix, Republic, Phoenix, AZ, 2/20/81.

- Final EA Completed for Gila Box Area

The Safford District, Bureau of Land Management has completed a final environmental assessment of the Geothermal Resources Leasing Proposal for the Gila Box Area, which lies between Safford and Clifton along the Gila River.

The proposal, according to Fritz U. Rennebaum, Safford district manager, is to allow leasing of the 181,000 acre area for geothermal exploration. The environmental assessment addresses only the initial exploration stages of resource development, since the true geothermal potential of the area is relatively unknown.

Phillips Petroleum has made nine separate applications for geothermal leases in the Gila Box area. If exploration discovers a viable geothermal resource then the lessee may apply to continue exploration and development.

Source: Eastern Arizona Courier, 2/11/81
Graham County Guardian, 2/11/81

CALIFORNIA

California leads the nation in geothermal energy development. The two main factors contributing to this leadership are the state's commitment to developing alternative energy resources and the existence of an abundant geothermal resource at The Geysers steam field, one of the best such fields in the world.

The geothermal energy scene in California is dominated by electric development and production at The Geysers field and electric development activities in the Salton Trough/Imperial Valley area. Direct use projects have received less attention. The existing installations are concentrated in the Lassen area, but industry has shown interest in using Salton/Imperial geothermal fluid for direct applications.

Developments at The Geysers have succeeded to the point where institutional issues common to large development projects now tend to dominate the news. These include disputes over environmental



Figure 2
Principal Geothermal Resource Areas in Arizona

STATE: ARIZONA

TABLE 2

LANDS LEASED AND/OR EXPLORED

REGION	AREAS/SITES INCLUDED	LEASEHOLDER/ DEVELOPER	ACREAGE LEASED		DEEP WELLS #
			Non-Competitive	Competitive	
MEXICAN HIGHLANDS	Chandler/Power Ranches, Inc.	Geothermal Kinetics	No Active Federal Leases		2
	Casa Grande/Pima Farms	Geothermal Kinetics			1

*Wells over 2000 feet known to be producible.

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STATE: ARIZONA

Code: UC[#] - Under Construction
 PR - Proposed
 OP - Operating
 U - Unknown

TABLE 3

ELECTRIC POWER AND DIRECT USE DEVELOPMENT ACTIVITY

REGION	AREAS/SITES INCLUDED	DEVELOPER	UTILITY	STATUS	MWe	ANNUAL BTU EQUIV (x 10 ⁹)	YEAR ON LINE/ OPERATIONAL
MEXICAN HIGHLANDS	Chandler/Power Ranches	U.S. Air Force		P		90	U
		U.S. Air Force		UC		90	U
					-	-	
					-	180	
Total, Operating							
Total, Other							

[#] For direct heat projects, construction begins with preliminary development activities such as exploratory drilling.

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impacts and controls and controversies over which level of government (federal, state, or county) will control expanded access to the resource and benefit from production royalties and taxes. Regardless of how these institutional issues are resolved, installed capacity at The Geysers should at least double by 1990, from the current 902 MW.

In the Salton Trough/Imperial Valley area, more than a decade of exploration, reservoir confirmations, and conversion technology research and engineering tests have brought this area to the brink of commercial development of electric power. The next three to five years will be very important in determining whether the substantial efforts to date to reduce both technical problems and financial risks associated with these reservoirs have been sufficient to bring them into routine commercial development.

The principal geothermal development activities in California have occurred in eight areas, as shown in Figure 3.

Leasing and Exploration

Most of the land under federal lease in California is held competitively in the Salton Trough/Imperial Valley region and in the Geysers-Calistoga KGRA. Greatest competitive leaseholders are Republic Geothermal in the Imperial Valley and Shell Oil and Union/Magma/Thermal in The Geysers-Calistoga KGRA.

The majority of the completed deep geothermal wells are situated in the Geysers-Calistoga KGRA and at several sites within the Imperial Valley. The principal developers at The Geysers are Union Oil, Magma Power, and Thermal Power, who have completed more than 160 deep producible geothermal wells since the mid-1960's. Other developers active in the area include Aminoil U.S.A. and Shell Oil. Natomas Company now owns the leases developed by Magma Power and Thermal Power at The Geysers.

The Imperial Valley sites have not been proven for electric power production on commercial scale. There have been a few deep well completions each year since extensive development began in the mid-1970's. Union Oil and Republic Geothermal have completed most of the deep geothermal wells. More detailed information pertaining to lands leased and/or explored is shown in Table 4.

Direct Heat Applications

Within the Lassen Known Geothermal Resource Areas, there are eight geothermal direct use developments. Hydroponic Farms and Hydroponics Inc. are operating a total of 36 geothermal greenhouses. Geothermal process energy is also being utilized by Hydroponic Farms to dry vegetables and wood waste. These applications currently consume about 47 billion Btu per year. The City of Susanville is constructing two separate district heating systems. The first project, which has received partial funding from the Department of Housing and Urban Development and the Farmers Home Administration, will retrofit 126 low- to moderate-income residences. Under the second project, 17 public buildings will be heated with geothermal energy. Partial funding has been provided by the Economic Development Administration. These direct use projects currently consume 66 billion Btu per year.

The Mono County Water District (Mammoth Lakes area) has proposed a residential and commercial district heating application. Annual geothermal utilization may reach 20 billion Btu.

Within the Salton Trough/Imperial Valley area, 13 direct use projects are under active consideration. Those applications span the East Mesa, Heber, and Salton Sea KGRAs and El Centro, Niland, and Brawley.

VTN Consolidated is investigating the economic feasibility of an industrial process heat application near East Mesa. San Diego Gas and Electric uses geothermal energy in a process heating and hot water application in Heber. Within the Salton Sea KGRA, Nakashima Nursery is pursuing four geothermal greenhousing developments.

Electric Power Development

Nearly all commercial geothermal electricity in the U.S. is generated from the geothermal resource in the Geysers-Calistoga KGRA. All fifteen units currently on line in The Geysers field have been developed by the Pacific Gas & Electric Company (PG&E). Collectively, these units generate a total capacity of 902 MWe of electricity. PG&E's nine proposed additional units, now in the construction, design and planning stages of development, will add 935 MWe of additional capacity by 1990. Eight additional geothermal electric power plants are being proposed by other utilities in The Geysers area. These facilities, also in varied stages of development, are expected to generate a total capacity of 551 MWe of electricity by 1985.

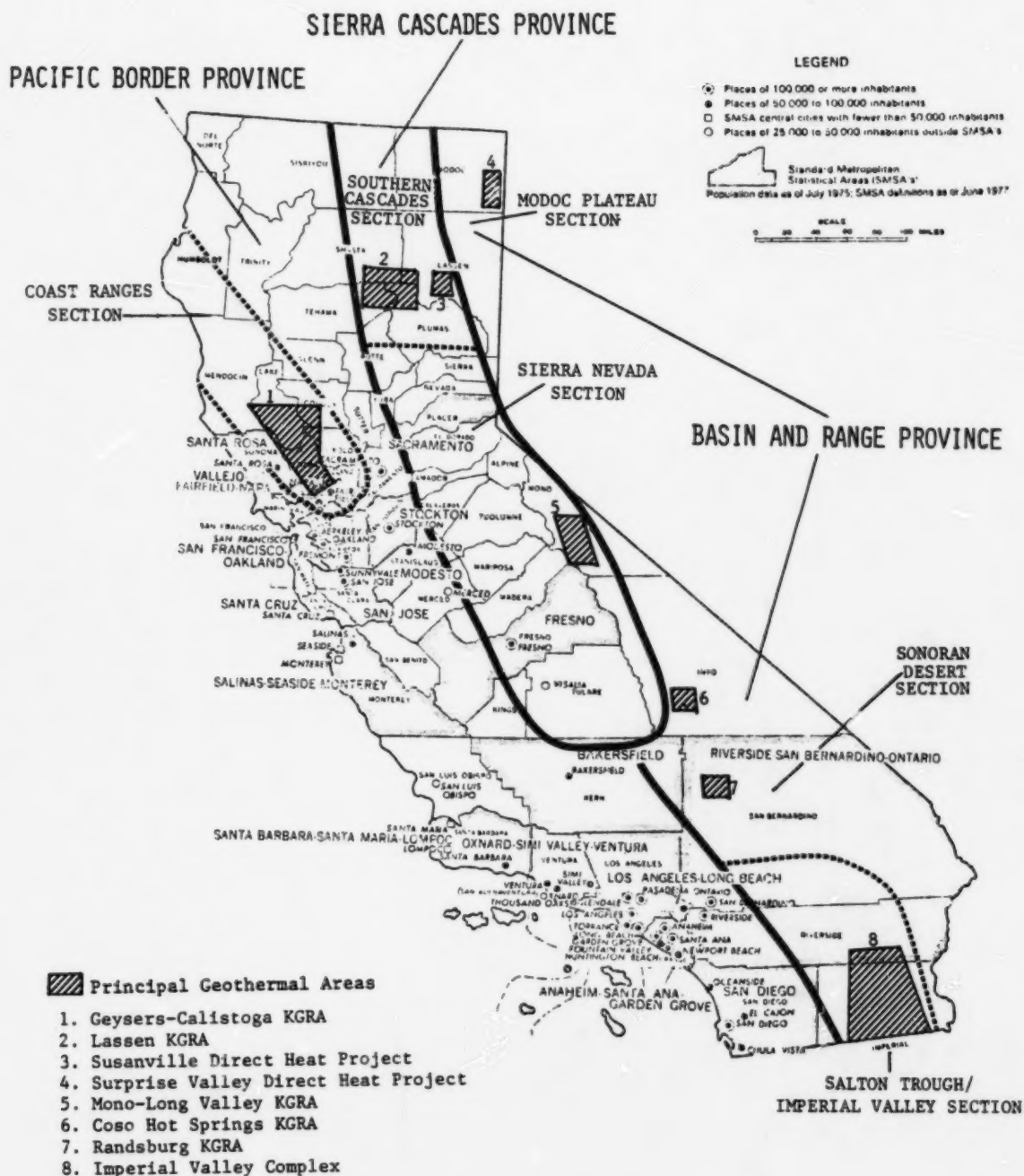


Figure 3

Principal Geothermal Resource Areas in California

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TABLE 4
LANDS LEASED AND/OR EXPLORED

REGION	AREAS/SITES INCLUDED	LEASEHOLDER*/ DEVELOPER	ACREAGE LEASED		DEEP WELLS #
			NON-COMPETITIVE	COMPETITIVE	
SOUTHERN CASCADES	Lassen KGRA Morgan Springs - Growler Lassen Susanville	Phillips Petroleum	No Active Federal Leases		1
SIERRA NEVADA	Mono Long Valley KGRA Mammoth Lakes	Geothermal Resources International City of Burbank		3710 1773	
SONORAN DESERT	Coso H.S. KGRA Randsburg KGRA	Kerr - McGee Chemical Corp.			
SALTON TROUGH/ IMPERIAL VALLEY	East Mesa KGRA Heber KGRA Westmorland KGRA Salton Sea KGRA Brawley KGRA El Centro Niland	Bureau of Reclamation	16	10	4
		Chevron USA			4
		Holly Sugar Corp.			-
		Magma Energy	5065		3
		Magma Power			5
		Mapco			
		Natomas Company	2243		
COAST RANGES	Geysers-Calistoga KGRA	Phillips Petroleum	641		
		Republic Geothermal		11744	15
		Union Oil		1920	13
		VTN et al.	2120		
		Private Individuals	641		5
		Other			
COAST RANGES	Geysers-Calistoga KGRA	Aminoil/Occidental		394	-
		Aminoil USA		745	38
		Occidental Geothermal		549	2
		Pacific Energy			10
		Shell Oil		6934	15
		State of California		471	
		Thermogenics		175	10
		Union-Magma-Thermal		5889	166
		Other			12

*Federal Lands Only

#Wells over 2000 feet known to be producible.

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Two electric power generating plants have been on line in the Imperial Valley. A 10 MWe plant in the Brawley KGRA, the first flashed steam plant to operate in the U.S., came on line in 1980. A 10 MWe pilot-scale binary-cycle plant also began operation in 1980. Accidental mechanical damage to the turbine forced the plant to shut down in November of the same year. The plant is currently on-line, but has not reached full operational status.

Nine additional plants are proposed for the Imperial Valley; these units have a potential generating capacity 403 MWe of power by 1986.

Other proposed power plants in California are located in the Coso, Mono-Long Valley, and Wendel-Amedee KGRAs. Both the Mono-Long Valley and Wendel-Amedee facilities are hybrid units, which utilize a combination of wood waste and geothermal fluid as energy sources. When operational, they will generate a total of 125 MWe of electricity.

Details of the projects summarized above are given in Tables 5 and 6.

Recent Major Activities

• Coso Land Order Modification Agreement Reached

The Secretary of the Navy and the Department of the Interior have agreed to permit development of the high potential geothermal resource at the China Lake Naval Weapons Center in the Coso Hot Springs area. The BLM is scheduled to offer lands in the Coso KGRA in a competitive lease sale in September. The original regional land order giving the Navy jurisdiction over about 30,000 acres in the Coso area did not allow for leasing of the geothermal resource. The Navy and BLM began to negotiate in December 1977 to allow leasing of the public-domain land at the China Lake facility. According to Dr. Carl Austin, head of the Geothermal Utilization Division at China Lake, the agreement could set a precedent for similar agreements regarding development of Department of Defense-controlled lands.

Source: PIC NGS, 6/5/81

• California to Propose Transfer of Federal Land to State

The California State Lands Commission is developing a proposal to transfer 2,000 acres of federal land in The Geysers KGRA to state ownership. California is also seeking mineral rights, now held by the federal government, to an additional 3,000 acres which it already owns in the KGRA.

The land transfer results from state indemnity selection provisions of federal law, under which California is due to receive 115,000 acres of federal land, the equivalent of two sections of federal land in each township at the time of statehood. The law provides that where the federal lands were already being used, the states could select other land. Restrictions on the State's selection are "a grey area" according to the BLM, Ukiah District Office, and it "appears" the state could even select land already in geothermal production.

The change in ownership would have many effects. The lands would no longer be controlled by the BLM and the fight for legislation (AB 1905) to divert some of the federal geothermal revenues to the county of origin would have to be fought again at a state level.

Source: The Geyser, 4/30/81.

• Geothermal Resource Ownership Litigation

The Ninth Circuit Court of Appeals recently reversed a federal district court decision asserting Union Oil of California's rights to geothermal resources beneath property at The Geysers and denying the federal government's rights to such resources. The Circuit Court concluded that, because geothermal resources were depletable subsurface reservoirs of energy akin to coal and oil deposits and because all elements of a geothermal system could be classified as minerals, the resource should be treated as a "mineral" within the meaning of the federal government's patent reservations.

In a second case involving Geothermal Kinetics, Inc. and Union Oil of California, the lessee of the mineral rights owner and the lessee of the surface owner each claimed ownership of the geothermal resources beneath a land parcel at The Geysers. The California Court of Appeals ruled that The Geysers geothermal resource was a "self-contained deposit...similar to minerals such as oil, natural gas, and coal," thus indicating that mineral ownership would include geothermal resources.

A third case involved a dispute between the State of California and a surface owner, each of whom claimed the right to royalties from steam used to generate electric power at The Geysers. The court determined that the geothermal resource system, being a depletable deposit having numerous mineral components, was a "mineral deposit", thereby ruling that the state is the owner of the geothermal resource beneath the lands in question.

Source: Geothermal Energy Magazine, 3/81.

STATE: CALIFORNIA

Code: UC[#] - Under Construction
 PR - Proposed
 OP - Operating
 U - Unknown
 A - Abandoned

TABLE 5

ELECTRIC POWER AND DIRECT USE DEVELOPMENT ACTIVITY

REGION	AREAS/SITES INCLUDED	DEVELOPER	UTILITY	STATUS	MWe	ANNUAL BTU EQUIV. (x 10 ⁹)	YEAR ON LINE/ OPERATIONAL
SOUTHERN CASCADES	Susanville	Susanville/Oakey Nursery	-	PR	-	.5*	U
		California Correctional Center	-	PR	-	60*	1982
		City of Susanville	-	UC	-	41	1981
		City of Susanville	-	UC	-	25*	U
	Lassen KGRA	Hydroponic Farms	-	OP	-	29	1978
		Hydroponics Inc.	-	OP	-	18	1972
		Lassen College	-	PR	-	100*	U
SIERRA NEVADA	Mono-Long Valley KGRA	Southern California Edison	Southern California Edison	PR	20	-	U
	Mammoth Lakes	County Water District	-	PR	-	20*	U
SONORAN DESERT	Coso H.S. KGRA	California Energy	U.S. Navy	PR	20	-	1984
		California Energy	U.S. Navy	PR	55	-	1989
	San Bernardino	City of San Bernardino		PR	-	100	U
SALTON TROUGH/ IMPERIAL VALLEY	East Mesa KGRA	Magma Power	San Diego Gas & Electric	10	-	-	1980
		Republic Geothermal	San Diego Gas & Electric	PR	50 ^{**}	-	-
		VTN Consolidated	-	PR	-	100*	U
	Heber KGRA	Chevron	San Diego Gas & Electric	PR	45	-	1984
		Chevron	Southern California Edison	PR	50	-	1984
		Chevron	Southern California Edison	PR	100	-	1989

* Annual energy use is a rough estimate.

** This plant may not come on-line because of the financial risk involved. Both parties are reevaluating the situation.

#For direct heat projects, construction begins with preliminary development activities such as exploratory drilling.

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STATE: CALIFORNIA

Code: UC - Under Construction
 PR - Proposed
 OP - Operating
 U - Unknown

TABLE 5 (Continued)

ELECTRIC POWER AND DIRECT USE DEVELOPMENT ACTIVITY

REGION	AREAS/SITES INCLUDED	DEVELOPER	UTILITY	STATUS	MWe	ANNUAL BTU EQUIV ⁹ (x 10 ⁹)	YEAR ON LINE/ OPERATIONAL
SALTON TROUGH/ IMPERIAL VALLEY (Continued)	Salton Sea KGRA	San Diego Gas & Electric	-	PR	-	10*	1977
	Salton Sea KGRA	Union Oil	Southern California Edison	UC	10	-	1983
		Magma Power	San Diego Gas & Electric	PR	20	-	1983
		Magma Power	San Diego Gas & Electric	PR	49	-	1985
		Nakashima Nursery	-	UC	-	9*	1981
		Nakashima Nursery	-	PR	-	35*	1985
		Nakashima Nursery	-	PR	-	43*	1990
		Nakashima Nursery	-	PR	-	85*	2000
	El Centro	City of El Centro	-	UC	-	7	1981
		Handler Industries	-	PR	-	100*	U
	Westmoreland KGRA	Mapco/Republic Geothermal	-	PR	48		1984
	Niland KGRA	Unknown (Ethanol Plant)	-	PR	-	600*	U
	Brawley KGRA	Union Oil	So. Calif. Edison	OP	10	-	1980
		CU-I Venture	California Dept. of Water Resources	PR	45	-	U
		Unknown	-	PR	-	600*	U
		Holly Sugar	-	PR	-	1300	1981
		Unknown	-	PR	-	2400*	U
		Mark Vesey	-	PR	-	600*	U
		MCR Geothermal	-	PR	-	600*	U
COAST RANGES	Geysers/ Calistoga KGRA	SEE TABLE 6 FOR ELECTRIC POWER DEVELOPMENT					
		Calistoga City Council	-	PR	-	5*	U

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STATE: CALIFORNIA

TABLE 5 (Concluded)

ELECTRIC POWER AND DIRECT USE DEVELOPMENT ACTIVITY

Code: UC⁶ - Under Construction
 PR - Proposed
 OP - Operating
 U - Unknown

REGION	AREAS/SITES INCLUDED	DEVELOPER	UTILITY	STATUS	MWe	ANNUAL BTU EQUIV (x 10 ⁹)	YEAR ON LINE/ OPERATIONAL
COAST RANGES	Geysers/Calistoga KGRA	Wine Valley Inn	-	UC	-	1 ^a	1982
Total, Operating**					912	47	
Total, Other**					2005	6842	
**Includes The Geysers (from Table 6)							

Code: UC - Under Construction
 PR - Proposed
 OP - Operating
 U - Unknown

TABLE 6

ELECTRIC POWER DEVELOPMENT AT GEYSERS/CALISTOGA KGRA

DEVELOPER	UTILITY	STATUS	MWe NET	YEAR ON LINE
Union-Magma-Thermal	Pacific Gas & Electric Co. (PG&E)	OP	11	1960
Union-Magma-Thermal	PG&E	OP	13	1963
Union-Magma-Thermal	PG&E	OP	27	1967
Union-Magma-Thermal	PG&E	OP	27	1968
Union-Magma-Thermal	PG&E	OP	53	1971
Union-Magma-Thermal	PG&E	OP	53	1971
Union-Magma-Thermal	PG&E	OP	53	1972
Union-Magma-Thermal	PG&E	OP	53	1972
Union-Magma-Thermal	PG&E	OP	53	1973
Union-Magma-Thermal	PG&E	OP	53	1973
Union-Magma-Thermal	PG&E	OP	106	1975
Union-Magma-Thermal	PG&E	OP	106	1979
Union-Magma-Thermal	Aminoil USA	OP	129	1980
Union-Magma-Thermal	Union-Magma-Thermal	OP	110	1980
Union-Magma-Thermal	Thermogenics	OP	55	1979
Aminoil USA	PG&E	PR	110	1983
Union-Magma-Thermal	PG&E	UC	110	1982
Union-Magma-Thermal	PG&E	UC	110	1982
Aminoil USA	PG&E	PR	55	1986
Union-Magma-Thermal	PG&E	PR	110	1986
Union-Magma-Thermal	PG&E	PR	110	1986
Union-Magma-Thermal	PG&E	PR	110	1990
Union-Magma-Thermal	PG&E	PR	110	1990
Union-Magma-Thermal	PG&E	PR	110	1990
Geothermal Kinetics	CA Dept. of Water Resources	PR	55	1986
MCO	CA Dept. of Water Resources	UC	55	1983/1984
MCO	CA Dept. of Water Resources	PR	55	1986
MCO	Northern California Power Agency	PR	66	1985
Shell Oil Co.	Northern California Power Agency	UC	110	1982
Aminoil USA	Sacramento Municipal Utility District	UC	72	1983
Shell Oil	Central Calif. Power Agency	PR	55-75	U
Occidental Geothermal, Inc.	-	PR	80	1984

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- California Energy Fund

A bill passed by the California Senate early this year established the State Assistance Fund for Energy Business and Industrial Development Corporation (SAFE-BIDCO). The non-profit corporation provides financial assistance in the form of direct loans to small businesses in the alternative energy industry or to small businesses planning to convert to alternative energy systems, including geothermal energy systems. The loan program has begun with a \$2.5 million line of credit from the state. All loans are to be partially guaranteed by the U.S. Small Business Administration. The guaranteed portion of the loans may then be sold to private investors in the capital market, allowing SAFE-BIDCO to regain its investment for continued lending.

Source: SAN Monthly Report, 5/8/81.

- Lake County Alliance Asks for Additional State Geothermal Revenues

A campaign to gain additional monies for local governments from state geothermal revenues has been initiated in Lake County, California. The Lake County Alliance, a nonprofit informational and educational organization working for economic and social improvement in Lake County, has launched efforts to obtain additional geothermal revenues for local government.

Counties of origin now receive a portion of federal geothermal lease and royalty monies under terms of Assembly Bill 1905, introduced by Assemblyman Douglas Bosco. The Alliance is proposing similar legislation which would return state geothermal revenues to Lake and other counties with geothermal development.

The Alliance has asked the Lake County Board of Supervisors to support its campaign and plans also to approach the Sonoma County Alliance and Sonoma County Board of Supervisors.

Source: GRC Bulletin, 5/81.

- California State Legislature Funds Geothermal Projects

The California State Legislature has allocated funds for at least two geothermal projects in this year's budget. About \$2 million will be set aside for integration of geothermal and/or cogeneration systems into existing state facilities. A geothermal heating system being installed in a Susanville correctional center is expected to receive the bulk of the funds. Additionally, the budget authorizes about \$400,000 for a sewage treatment plant in San Bernardino which will utilize geothermal process heat.

Source: SAN Weekly Activity Report, 6/18/81.

- Calistoga, California Debates Geothermal Energy Use

At a Calistoga City Council meeting held in March 1981, the use of geothermal water to space condition the proposed Wine Valley Inn was promoted by some as a way to save energy and help curb rising utility rates. However, several spa owners and bottled water company managers commented that the planned reinjection process could cool the geothermal pool and that an accident could pollute the pool, rendering it useless to other commercial entities. Opponents of the project sought modification or revocation of a use permit issued for construction of the planned facility.

Engineers from the State Department of Mines and Geology, the Division of Oil and Gas, and the Department of Health Services spoke to the Council, giving the preliminary results of a year-long examination of Calistoga's geothermal pool and reporting on requirements imposed by the state on people who tap the pool. The Council was told that the Division of Oil and Gas reviews all projects to determine what treatment is given the water, how and how fast it is reinjected, and the characteristics of the ground in the reinjection area. It was also noted that the state has the power to close down the well if there is evidence of damage and that it would stop the sale of bottled water if the geothermal pool became polluted.

The Crystal Geyser Water Company suggested that McNulty post a \$30 million bond to cover destruction of the geothermal pool.

Source: SAN Monthly Report, 5/8/81.

- Test Wells for California Correctional Center Drilled

The Lassen County Planning Commission has granted a use permit to the Carson Development Company to drill wells for a prison retrofit. A 300-acre geothermal lease has been obtained at the site and an additional 400-acre surface development lease is under negotiation. The hot water will be piped

to the prison for geothermal space heating and returned for uses such as greenhousing, ethanol production, and swine raising.

Correctional center officials have requested \$1.7 million for the geothermal retrofit and conservation measure, although authorization has not yet been announced. The City of Susanville will manage the project and sell geothermal water to the center. Officials are hoping to displace 600,000 gallons of heating oil annually, or 70 percent of the prison's current use of oil. The city is also applying for \$90,000 in funds for engineering design.

Source: Lassen Advocate, Susanville, CA, 3/9/81.

• BLM Proposals Announced

Recent BLM actions on several California sites are listed below:

East Mesa - The final EA has been published. Forty-five pending noncompetitive lease applications can now be processed. (The area does not include the East Mesa KGRA).

Glamis/Dunes - A draft EA has been published. The action should allow processing of 38 noncompetitive leases and will make available a total lease area of 194,000 acres, including the Glamis and Dunes KGRAs, to be scheduled for lease sale pending the outcome of the public comments on the areas.

Yuha Desert - The final Environmental Analysis has been published, clearing the way for noncompetitive leasing in nine geothermal areas.

Pisgah - An EAR for geothermal and sodium leasing has been prepared.

Source: GRC Bulletin, Feb. - March/81.

• Power Plant Development Activities Continue

Recent development activities at specific geothermal power plant sites in California are summarized below.

Heber - Southern California Edison Co.

The California Public Utilities Commission has rejected Southern California Edison's application for a Certificate of Public Convenience and Necessity for the 50 MWe flash steam geothermal power plant at Heber. Southern California Edison (SCE) has a fuel contract agreement with Chevron for the plant.

Source: Southern California Edison, 7/81.

Geysers - Pacific Gas & Electric Company Unit #16

Pacific Gas & Electric Company (PG&E) has been granted a Certificate of Public Convenience and Necessity by the California Public Utilities Commission (CPUC) to construct and operate a double-circuit 230 kV transmission line between Lakeville Substation in Sonoma County and its Sobrante Substation in Contra Costa County. Construction is conditional on CPUC approval of Unit #16 and a transmission line to the Lakeville Substation.

Source: GRC Bulletin, 5/81.

Bottle Rock - California Department of Water Resources

Ground breaking ceremonies were held May 6, 1981 for the Bottle Rock 55 MWe power plant located on the Francisco leasehold in The Geysers geothermal field. This facility will be constructed, owned and operated by the State of California's Department of Water Resources.

Ghillotti Brothers, Inc. of San Rafael, California submitted the lowest bid of \$869,959 for initial site development work.

Source: The Geyser, 5/81.

Geysers - Sacramento Municipal Utility District

Plant construction began on April 1, 1981 on SMUDGE #1, a 75 MWe geothermal power plant, located in Eastern Sonoma County near the Lake County line.

South Geysers - California Department of Water Resources

The California Energy Commission (CEC) has approved the California Department of Water Resources (DWR) Application for Certification (AFC) for its 55 MWe geothermal electric plant, located in the northeastern portion of Sonoma County.

Source: GRC Bulletin, 6/81.

CCPA #1 - Central California Power Agency

The Sacramento Municipal Utility District (SMUD), acting as lead agency, has approved the formation of a joint power agency with the Modesto Irrigation District (MID) and the cities of Redding and Santa Clara. The consortium will be called the Central California Power Agency (CCPA) and is proposing the development of a 55-75 MWe geothermal electric power plant in northern California's Sonoma County.

MID and Shell Oil have signed an agreement for test drilling for the project. Engineers are currently studying possible test drilling sites on a 3200-acre lease block Shell acquired from Hilary Farms. Drilling is anticipated to begin in October on a 10,000 foot geothermal test well. MID has agreed to spend the first \$2.2 million on the test well and split further costs with Shell on a 50-50 percentage basis.

Source: Petroleum Information Corporation, 4/10/81

Wendel-Amedee - Geoproductions Hybrid Plant

The Geoproductions Corporation of Oakland and the U.S. Department of Energy have signed \$1.5 million contract in a cooperative agreement to drill a 5000 foot geothermal production well near Wendel, California. The energy resources will be used to dehydrate a combination of wood wastes to be used for a 55 MWe electrical demonstration plant. The California Department of Water Resources has agreed to purchase electricity from the plant for operation of the State Water Project.

Source: Petroleum Information Corporation, 4/24/81.

COLORADO

Low- to moderate-temperature resources can be found at scattered sites in Colorado. These are being used for direct heat applications.

Leasing and Exploration

Five areas in Colorado appear to have significant geothermal resource potential. Figure 4 shows the locations of these areas. There are no active federal leases and no completed deep wells in the identified resource areas.

Direct Heat Applications

Geothermal direct heat applications in the Alamosa area include heating of the Alamosa Shopping Center, barley malting, and a multiple-use project, currently under construction by the City of Alamosa, which incorporates space heating of Adams State College. In the San Luis Valley, projects are underway for process heating at Alamosa Mushroom Farms and commercial space heating of a shopping mall; another commercial space heating project and an ethanol plant have been proposed. Geothermal resources are being used for residential space heating and fish farming in the Sand Dunes area, and a greenhouse application has been proposed. These projects are listed in Table 7.

Recent Major Activities

• Alamosa, Colorado Selected as Agripark Site

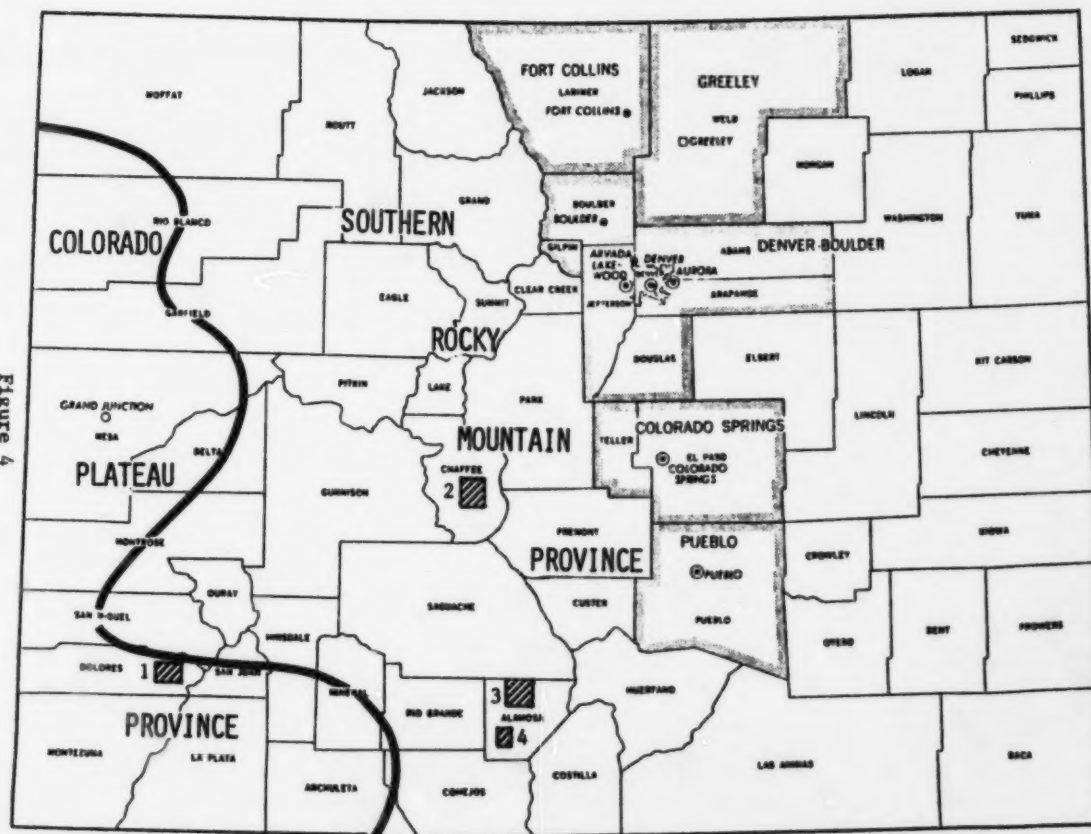
The Alamosa Mushroom Farm near Alamosa, Colorado has been chosen as the site for exploratory drilling in the second phase of a program to develop a geothermal-based industrial park in southern Colorado. The project is being funded by the Four Corners Regional Commission through the Southern Colorado Economic Development District (SCEDD).

A test geothermal production well to prove the on-site resource availability is scheduled to be drilled during the summer of 1981. If the hot-water resource is confirmed as expected, the geothermal industrial park could play an important role in strengthening the San Luis Valley region's economy. Other proposed industries for the agripark include a poultry farm and greenhousing and aquacultural applications.

Source: GRC Bulletin, 5/81.

Principal Geothermal Resource Areas in Colorado

Figure 4



LEGEND

- Places of 100,000 or more inhabitants
- Places of 50,000 to 100,000 inhabitants
- SMSA central cities with fewer than 50,000 inhabitants
- Places of 25,000 to 50,000 inhabitants outside SMSA's



Standard Metropolitan Statistical Areas (SMSA's)

Population data as of July 1975; SMSA definitions as of June 1977

SCALE
0 10 20 30 MILES

- ▨ Principal Geothermal Areas
- 1. Paradise Hot Springs
- 2. Chalk Creek Hot Springs
- 3. San Luis Valley/Sand Dunes
- 4. Alamosa

STATE: COLORADO

Code: UC[#] - Under Construction
 PR - Proposed
 OP - Operating
 U - Unknown

TABLE 7

ELECTRIC POWER AND DIRECT USE DEVELOPMENT ACTIVITY

REGION	AREAS/SITES INCLUDED	DEVELOPER	UTILITY	STATUS	MWe	ANNUAL BTU EQUIV. (x 10 ⁹)	YEAR ON-LINE/ OPERATIONAL
RIO GRANDE RIFT/SAN LUIS DEPRESSION	Alamosa	Alamosa Shopping Center	-	OP	-	5*	U
		Baca Grande Corp.	-	PR	-	1*	U
		City of Alamosa	-	UC	-	5*	U
	San Luis Valley	Alamosa Mushroom Farms	-	UC	-	100*	U
		Baca Grande Community	-	PR	-	5*	U
		Gibson Building	-	UC	-	50*	U
		Westec Services	-	PR	-	1200*	U
	Sand Dunes	B. R. Jenkins	-	OP	-	.7	U
		B. R. Jenkins	-	OP	-	50	U
		Charles Underwood	-	PR	-	.5*	U
	Total, Operating				-	55.7	
	Total, Other				-	1361.5	

*Annual energy use is a rough estimate.

#For direct heat projects, construction begins with preliminary development activities such as exploratory drilling.

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• Geothermal Heating Proposed for Colorado State Buildings

Western Energy Planners, Ltd. recently completed a study showing economic feasibility of heating selected state buildings with geothermal energy. The study evaluated geothermal heating for state buildings in Alamosa, Buena Vista, Burlington, Durango, Glenwood Springs and Steamboat Springs and concluded that geothermal heating of 45 percent of the buildings studied was economical.

Source: GRC Bulletin, February/March 1981.

HAWAII

Though only one geothermal project is operating in Hawaii, the state has one of the hottest geothermal resources in the world. This resource is currently being tapped to generate electricity in the Puna district and further development is planned. The first state leases for geothermal development on the Island of Hawaii were recently signed.

Leasing and Exploration

The principal geothermal resource area in Hawaii is identified on the map in Figure 5. Two deep producible wells have been completed and several other sites have been staked preparatory to drilling. As shown in Table 8, no federal leases are currently held in Hawaii.

Electric Power Development

A 3 MWe geothermal power plant in the Puna district became operational in July 1981. The plant, located on the eastern rift zone of the Kilauea volcano, uses a wellhead generator. The project is the first to produce electricity from a geothermal resource in Hawaii and is expected to meet the electrical requirements of 3,500 people. The Hawaii Electric Light Company, which operates the plant, is also involved in the development of a proposed 25 MWe geothermal electric plant in the Puna district. Thermal Power Company and Dillingham Corporation recently formed a joint venture to pursue the development of this facility, which is scheduled to come on line in 1988.

These projects are shown in Table 9.

Recent Major Activities

• State Leases Issued in Hawaii

Hawaii's state land board has approved two leases for geothermal exploration on the Island of Hawaii. The leases, granted to Bishop Estate and Kapoho Land Partnership are the first geothermal leases to be signed in Hawaii. The two landowners will sublease the mineral rights to a joint venture of Dillingham Corporation of Hawaii and Thermal Power Company of California, who will drill wells for development of geothermal electric power eventually to be sold to the Hawaii Electric Light Company.

Source: SAN Monthly Report, 5/8/81
GRC Bulletin, 5/81

IDAHO

Idaho is a state of extensive direct heat development, most of which is in the Boise area. Electric power development is limited to a pilot-scale plant in the Snake River plain. The state has demonstrated its commitment to developing its geothermal resources by pursuing a project to retrofit the Capitol Mall for geothermal space heating.

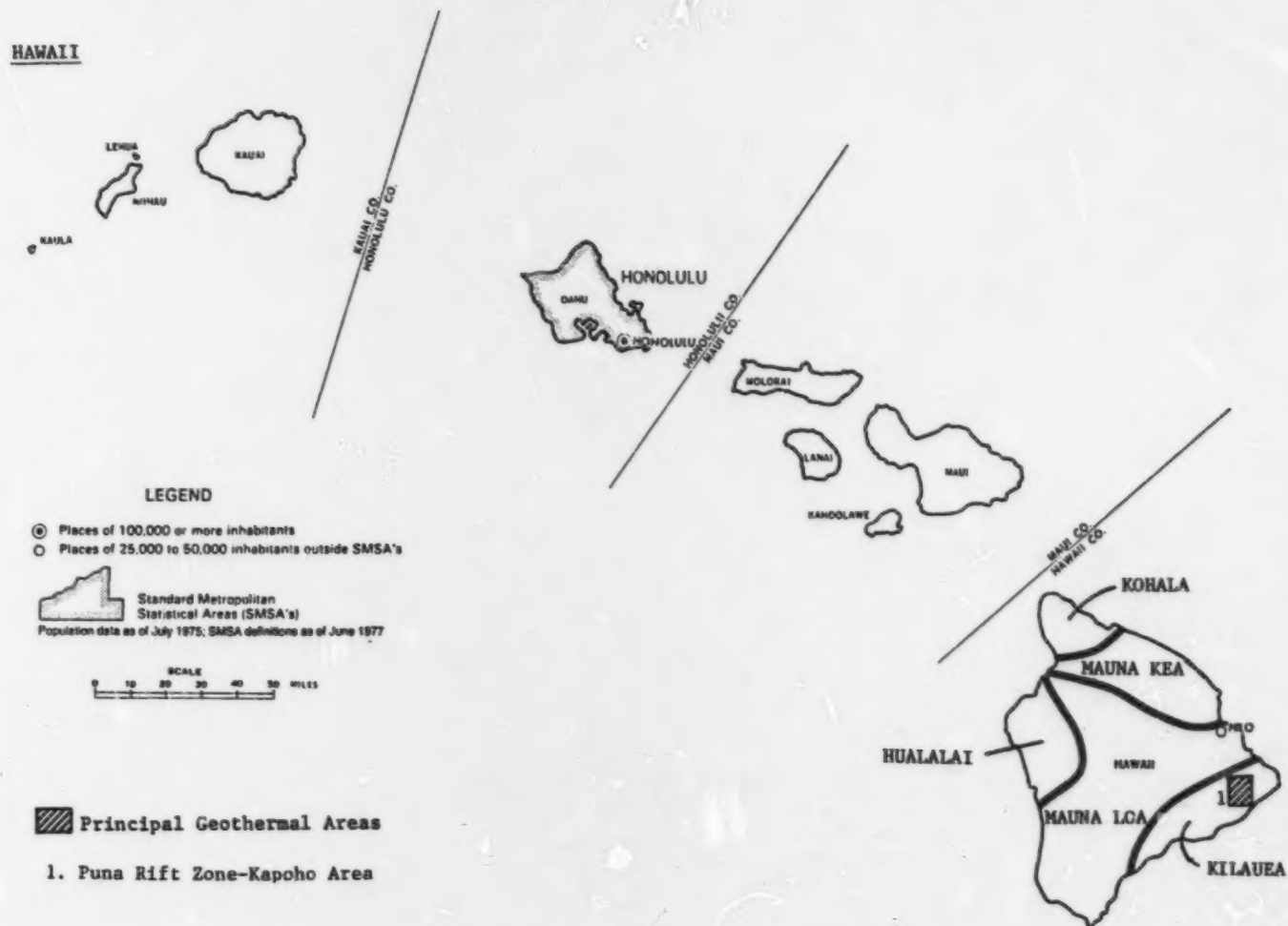
Leasing and Exploration

There are nine principal geothermal resource areas in Idaho, as shown in Figure 6.

Most leases in Idaho are held noncompetitively. The only competitive leaseholders in the identified geothermal resource areas are Magma Energy and Union Oil, who hold joint leases near Mountain Home, and Occidental Geothermal in the Crane Creek KGRA. Overall, the principal leaseholders are Magma/Union, Chevron USA, Sunedco, and Atlantic Richfield. The greatest amount of land is leased noncompetitively in the Snake River Plain region, which includes the Raft River area.

Principal Geothermal Resource Areas in Hawaii

Figure 5



STATE: HAWAII

TABLE 8

LANDS LEASED AND/OR EXPLORED

REGION	AREAS/SITES INCLUDED	LEASEHOLDER / DEVELOPER	ACREAGE LEASED		DEEP WELLS [#]
			Non-Competitive	Competitive	
PUNA RIFT ZONE	Kapoho Area	Hawaii Geothermal Project	No Active Federal Leases		1
		Colorado School of Mines			1

[#]Wells over 2000 feet known to be producible.

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A total of five deep producible wells have been completed in Idaho. Details of the leasing and exploration activity are given in Table 10.

Direct Heat Applications

Major uses of geothermal direct heat in Idaho are space heating, fish farming, food processing, and greenhousing.

Five geothermal direct heat projects are in operation in the Boise area. Most of these projects provide residential space heating. A system to provide space heating to seven state buildings, including the capitol, is under construction.

Near Mountain Home, the U.S. Air Force is investigating feasibility of a space heating project for the Air Force base.

Agricultural and industrial applications of geothermal resources of the Snake River Plain are proposed or under construction at Pocatello, Raft River, and Rexburg. These include a barley malting project at Pocatello, food processing at Rexburg, and in the Raft River area, fish farming, potato peel drying, and three ethanol plants.

Other Idaho projects which are currently in operation include greenhousing and tropical fish breeding at Buhl. Proposed applications include ethanol plants at Kimberly and Twin Falls and campus heating at the College of Southern Idaho in Twin Falls.

Electric Power Development

A 5 MWe pilot-scale geothermal electric power plant has been constructed in the Raft River KGRA. This plant was built under a DOE project to investigate and demonstrate the feasibility of generating electricity from moderate-temperature geothermal resources. The operating and testing phases for this unit will be carried out by EG&G Idaho, Inc. and the Geothermal Power Development Group, a joint venture of four utilities (Washington Public Power Supply System, Idaho Power Company, Raft River Rural Electric Cooperative, and the Snake River Power Association). Power on line is scheduled for the end of this year.

Details of electric power and direct heat projects in Idaho are presented in Table 11.

MONTANA

High-temperature resources are not known to exist in Montana. There are a few direct heat projects being carried out.

Leasing and Exploration

The locations of the two principal geothermal resource areas in Montana are shown in Figure 7. As can be seen in Table 12, there are no active federal leases in the identified areas and only one deep, producible well has been completed.

Direct Heat Applications

Geothermal resources are being used at White Sulphur Springs for space heating of a bank and operation of a motel and spa. These projects are shown in Table 13.

NEVADA

Though there is now no geothermal electric power on line in Nevada, the state follows California in geothermal resource potential. The availability of promising high-temperature resources in Dixie Valley, Beowawe, and Steamboat Springs has prompted a group of regional utilities to form a consortium to develop geothermal power in the state.

Leasing and Exploration

As can be seen in Figure 8, Nevada contains numerous geothermal resource areas. However, deep producible wells have been completed at only five of the sites.

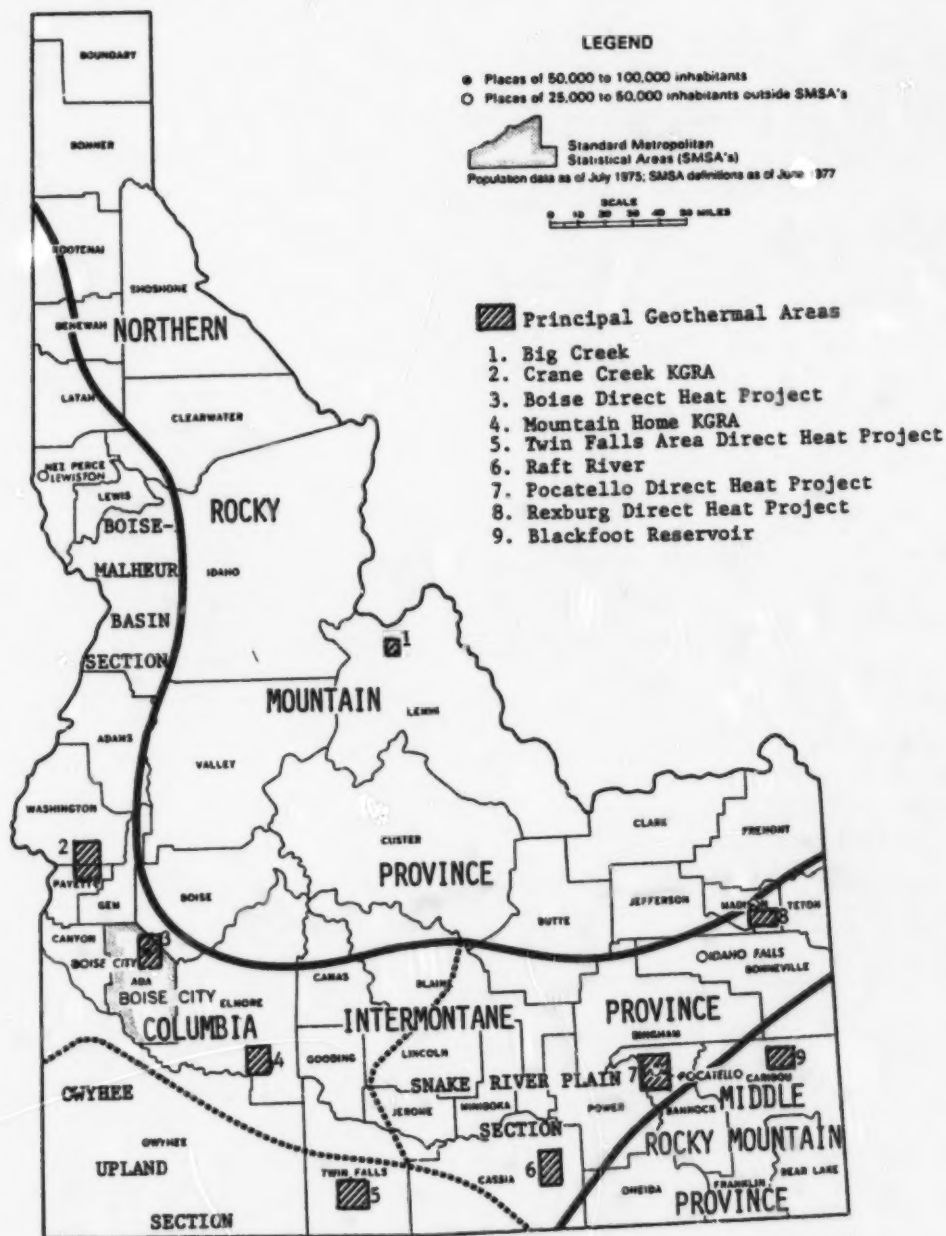


Figure 6
Principal Geothermal Resource Areas in Idaho

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STATE: IDAHO

TABLE 10

LANDS LEASED AND/OR EXPLORED

REGION	AREAS/SITES INCLUDED	LEASEHOLDER*/ DEVELOPER	ACREAGE LEASED		DEEP WELLS [#]
			Non-Competitive	Competitive	
HIGH LAVA PLAINS/ MALHEUR-BOISE BASIN	Crane Creek KGRA/Cove Creek Mountain Home KGRA Little Creek, H.S. Boise	Atlantic Richfield Earth Power Corp. Hassie Hunt Exploration Magma/Union Oil Co. Occidental Geothermal State of Idaho Thermal Resources, Inc. U.S. Geothermal Corp. Private Individuals	5,609 2,399 4,574 16,123 1,638 3,120 19,106	5,983 2,600	1
SNAKE RIVER PLAIN	Pocatello Rexburg Raft River	Anadarko Chevron USA INEL (DOE)/E.C. & G. Phillips Petroleum Southland Royalty Sunedco Supron Private Individuals	5,650 14,908 2,020 402 13,704 2,843 21,968		4
OWYHEE UPLAND	Buhl Kimberly Miracle H.S. Twin Falls	Amax Exploration Atlantic Richfield	7,501 13,545		
IDAHO BATHOLITH	Big Creek		No Active Federal Leases		

* Federal lands only.

[#]Wells over 2000 feet known to be producible.

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STATE: IDAHO

Code: UC[#] - Under Construction
 PR - Proposed
 OP - Operating
 U - Unknown

TABLE 11

ELECTRIC POWER AND DIRECT USE DEVELOPMENT ACTIVITY

REGION	AREAS/SITES INCLUDED	DEVELOPER	UTILITY	STATUS	MWe	ANNUAL BTU EQUIV ($\times 10^9$)	YEAR ON-LINE/ OPERATIONAL
SNAKE RIVER PLAIN	Raft River	Mr. Crook	-	PR	-	13.9	U
		Unknown (Fish Farm)	-	OP	-	5	U
		Unknown (Ethanol Plant)	-	PR	-	300*	1982
		Unknown (Ethanol Plant)	-	PR	-	30*	U
	Rexburg	Madison County Energy Commission	-	UC	-	780	1981
OWYHEE UPLAND	Buhl	Archibald's	-	OP	-	1	U
		Fish Breeders of Idaho	-	OP	-	788	1974
		Unknown	-	OP	-	1	U
		Unknown	-	PR	-	100*	U
		Valley Trout Farms	-	OP	-	100*	U
		Valley Trout Farms	-	PR	-	60*	U
	Kimberly	Agricultural Exper. Station	-	PR	-	1*	U
		J. H. Henry Produce	-	PR	-	300	U
	Miracle Hot Springs	Unknown (Resort)	-	OP	-	.5	U
	Twin Falls	College of Southern Idaho	-	PR	-	3	1983
		D. Armstrong	-	PR	-	12*	U
		Western Resource Recovery	-	PR	-	360*	U

*Annual energy use is a rough estimate.

#For direct heat projects, construction begins with preliminary development activities such as exploratory drilling.

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STATE: IDAHO

TABLE 11 (Concluded)

ELECTRIC POWER AND DIRECT USE DEVELOPMENT ACTIVITY

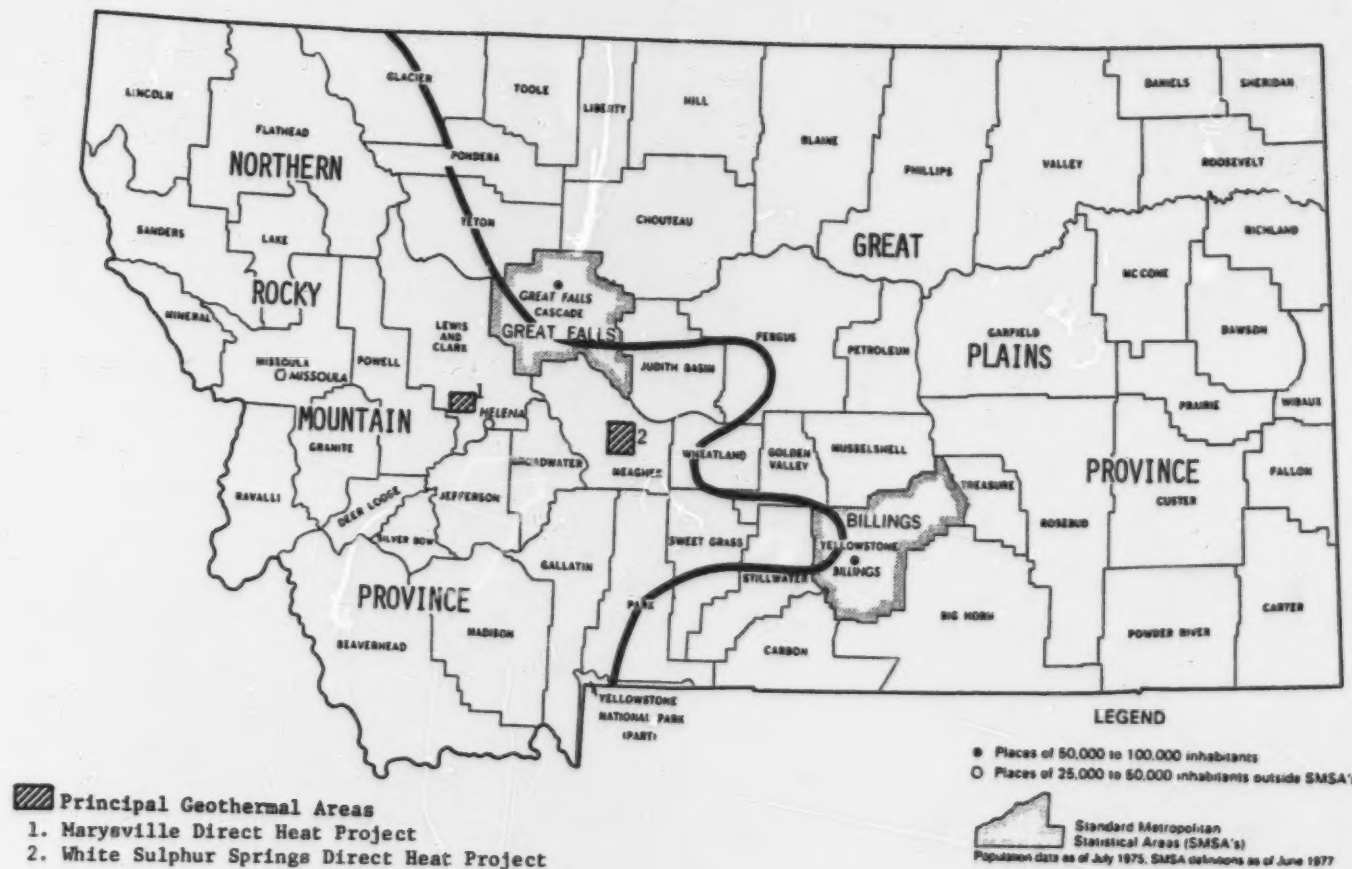
REGION	AREAS/SITES INCLUDED	DEVELOPER	UTILITY	STATUS	MWe	ANNUAL BTU EQUIV. (x 10 ⁹)	YEAR ON-LINE/ OPERATIONAL
HIGH LAVA PLAINS/ MALHEUR-BOISE BASIN	Boise	Capitol Mall	-	UC	-	63	1983
		Edwards	-	OP	-	1	U
		Elks Rehabilitation Hospital	-	PR	-	10	U
		Hunt Brothers Floral	-	OP	-	1	U
		State of Idaho	-	OP	-	11	1977
		V.A. Hospital	-	PR	-	10	1983
		Warm Springs Hollow	-	UC	-	207	1982
		Warm Springs Water District	-	OP	-	80	1900
		Warm Springs Water District	-	OP	-	400	1920
		Warm Springs Water District	-	OP	-	320	1970
	Mountain Home	U. S. Air Force	-	PR	-	.2	U
SNAKE RIVER PLAIN	Pocatello	Great Western Malting	-	PR	-	100*	U
	Raft River KGRA	INEL/EG&G	-	UC	5	-	1981
		Bechtel National	-	PR	-	1200*	U
		EG&G/Univ. Idaho	-	PR	-	100*	U
		McDonalds/EG&G	-	PR	-	100*	U
Total, Operating					-	1708.5	
Total, Other					5	3750.1	

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Principal Geothermal Resource Areas in Montana

Figure 7



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STATE: MONTANA

TABLE 12

LANDS LEASED AND/OR EXPLORED

REGION	AREAS/SITES INCLUDED	LEASEHOLDER / DEVELOPER	ACREAGE LEASED		DEEP WELLS [#]
			Non-Competitive	Competitive	
NORTHERN ROCKY MOUNTAINS	Marysville	Battelle Pacific NW Laboratory	No Active Federal Leases		1
	White Sulphur Springs				

[#]Wells over 2000 feet known to be producible.

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STATE: MONTANA

Code: UC - Under Construction
 PR - Proposed
 OP - Operating
 U - Unknown

TABLE 13

ELECTRIC POWER AND DIRECT USE DEVELOPMENT ACTIVITY

REGION	AREAS/SITES INCLUDED	DEVELOPER	UTILITY	STATUS	MWe	ANNUAL BTU EQUIV ⁹ (x 10 ⁹)	YEAR ON LINE/ OPERATIONAL
NORTHERN ROCKY MOUNTAINS	White Sulphur Springs	First National Bank White Sulphur Springs Motel Spa		OP	-	.5	1980
				OP	-	.5	U
					-	1.0	
					-	-	
Total, Operating							
Total, Other							

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Principal leaseholders in Nevada are O'Brien Resources, Atlantic Richfield, and Amax, all leasing primarily in Dixie Valley, as well as Aminoil and Sunedco, Anadarko, Phillips, and the American Geothermal Drilling Company. The majority of competitive leases in the identified geothermal resource areas are held by Aminoil/Sunedco, Phillips, and Republic Geothermal.

Table 14 contains more detailed information about the leasing and exploration activity in the state.

Direct Heat Applications

A major use of geothermal direct heat in Nevada is for residential and district space heating. A number of projects are underway at Steamboat Springs, where three schools and a police and fire station are heated geothermally, and in the city of Reno, where several district heating projects are proposed or under construction. The Hydrothermal Energy Corporation is developing geothermal resources for residential space and water heating for a large apartment complex and for the MGM Grand Hotel. A large community in Reno is already being heated geothermally and a geothermal district heating system for a 112-acre subdivision is currently under construction.

Ethanol plants are proposed by developers in the Humboldt area, in the Brady-Hazen KGRA, and Wabuska Hot Springs. An ethanol plant is currently being operated by Tad's Enterprises at Yerington.

Electric Power Development

The Northern Nevada Utility Group (NORNEV), a group of five utilities (Sierra Pacific Power Company, Sacramento Municipal Utility District, Eugene Water and Electric Board, Pacific Power and Light Company, and Portland General Electric) has proposed construction of a 10 MWe power plant at Dixie Valley. Two other 10 MWe plants at Steamboat Springs and Beowawe may follow. Experimental power plant permitting procedures are under way at Dixie Valley, Beowawe and Steamboat Springs. NORNEV will use the test data in the design of their first 10 MWe unit to be constructed in Nevada in the next two years.

Electric power and direct heat activities are summarized in Table 15.

Recent Major Activities

• Nevada Legislation Generates Controversy

A comprehensive bill intended to define geothermal energy and encourage utilities to develop alternative energy sources has polarized utility companies and consumer advocates around ratemaking policies suggested by the bill. One of the controversial sections of the bill would allow utilities developing alternative energy sources such as wind, solar, and geothermal power to bill consumers for construction work in progress, recover costs from consumers in the case of project failure, liberalize inter-utility power sales, and peg prices charged for alternative energy to conventional sources such as oil, coal, and natural gas.

Source: SAN Monthly Report, 5/8/81.

NEW MEXICO

New Mexico contains numerous low- to moderate-temperature geothermal resources suitable for direct heat applications, as well as some high-temperature resources in the Baca ranch area in the Jemez Mountains. Development of this area has been and promises in the future to be controversial. The issue of infringement on the religious rights of the indigenous Pueblo Indians by power plant development in the area has already been raised. In addition, fear of encroaching upon the scenic beauty of the mountain area is likely to create opposition to power projects in the future. Legislators have already tried to pass bills protecting the area from proliferation of geothermal power plants.

Leasing and Exploration

Figure 9 is an index map of the six principal geothermal resource areas in New Mexico. Although the majority of the sites lie within the Rio Grande Rift, deep producible wells have been completed in only one of these areas (Baca Location No. 1 KGRA).

Most of the leases are in or around the Lightning Dock KGRA and in the Baca Location No. 1 KGRA, site of a proposed 50 MWe power plant. Principal competitive leaseholders are Amax, Phillips, and Aminoil. Overall, Amax has the largest amount of land under lease in New Mexico.

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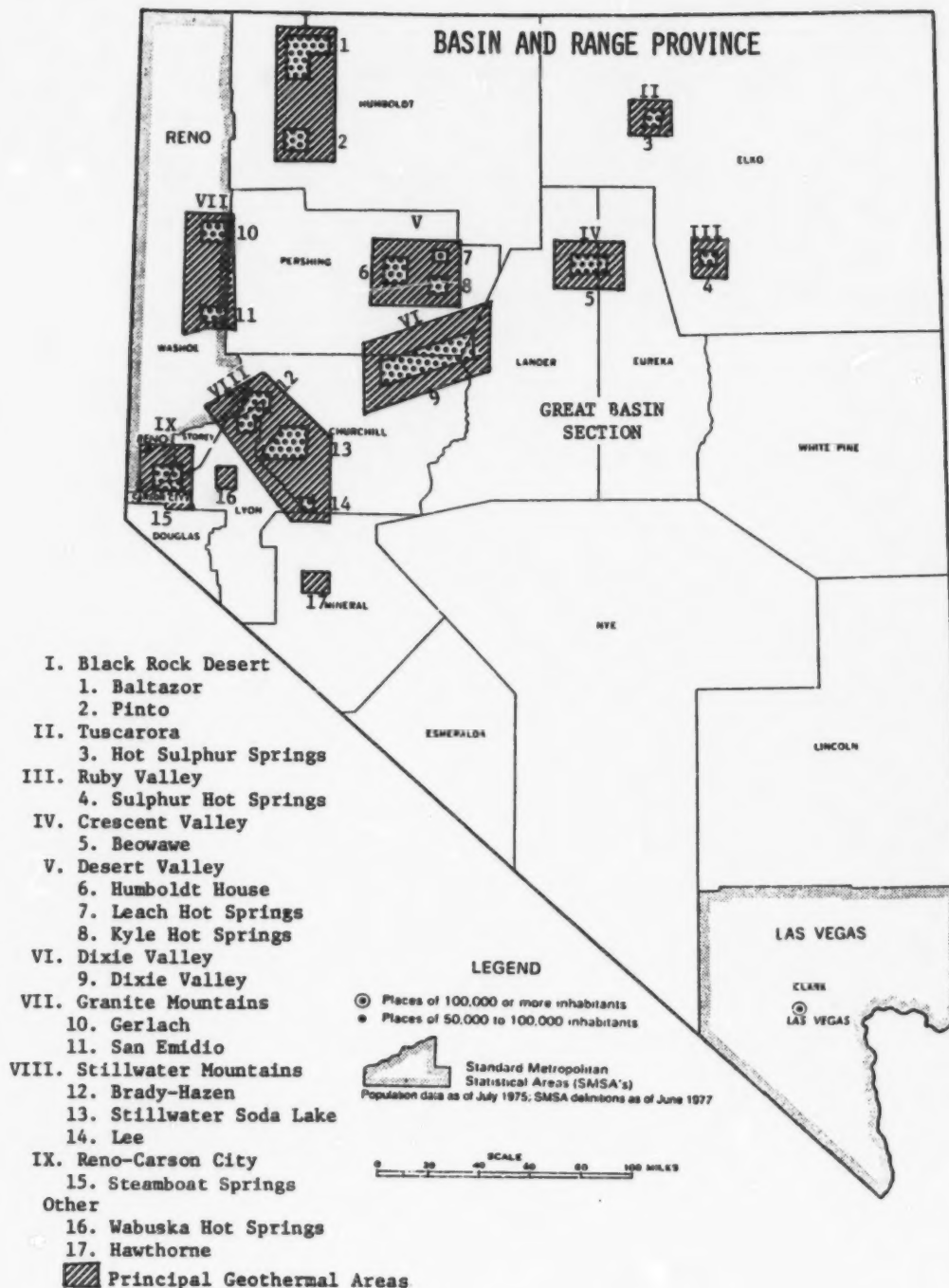


Figure 8

Principal Geothermal Resource Areas in Nevada

STATE: NEVADATABLE 14
LANDS LEASED AND/OR EXPLORED

REGION	AREAS/SITES INCLUDED	LEASEHOLDER*/ DEVELOPER	ACREAGE LEASED		DEEP WELLS
			Non-Competitive	Competitive	
BLACK ROCK DESERT	Baltazor Pinto	Continental Geothermal Corp. Earth Power Thermal Resources, Inc. U.S. Geothermal Corp. Private Individuals	7,363 12,151 13,506 10,723 14,456	1,253 5,537 7,975	
DESERT VALLEY	Humboldt House Leach Kyle	Aminoil USA, Inc. Aminoil USA & Sunoco Development Corp. American Geothermal Drilling Co. Chevron USA, Inc. Phillips Petroleum Co. Union Oil Private Individuals	16,419 11,016 18,695 8,949 3,700 51,095	12,246 2,400 	
EAST SLOPE GRANITE MOUNTAINS	Great Boiling Springs - Gerlach San Emidio	Aminoil USA, Inc. Calvert Drilling Occidental Geothermal, Inc. Sunoco Energy Research & Development Corp. Private Individuals	2,271 1,280 24,178	5,123 6,616 6,245 	1
STILLWATER MOUNTAINS	Brady-Hazen Stillwater-Soda Lake Lee	Andarko Production Co. Chevron Oil Co. & Phillips Petroleum Chevron USA, Inc. Earth Energy Geoproducs Corp. Geothermal Resources International Magma Power & Union Oil Co. Phillips Petroleum Co. Occidental Geothermal, Inc.	18,008 1,353 3,302 5,703	2,480 1,852 13,426	1

* Federal lands only.

#Wells over 2000 feet known to be producible.

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STATE: NEVADATABLE 14 (Continued)
LANDS LEASED AND/OR EXPLORED

REGION	AREAS/SITES INCLUDED	LEASEHOLDER*/ DEVELOPER	ACREAGE LEASED		DEEP WELLS
			Non-Competitive	Competitive	
STILLWATER MOUNTAINS (Continued)		Sulphur River Explora- tion, Inc.	3,200		
		Supron Energy Corp.	4,385	5,120	
		Thermal Power Co.		2,561	
		Union Oil Co. & Magma Energy, Inc.		1,505	
		Union Oil of Calif. Private Individuals	5,012 15,430	643 1,269	
RUBY VALLEY	Sulphur Hot Springs	Thermex Co. Union Oil of California	2,680 745	3,823	
TUSCARORA	Hot Sulphur Springs		No Active Federal Leases		
CRESCENT VALLEY	Beowawe	Chevron USA, Inc.	5,699	6,250	1
		Getty Oil Co.	1,287	4,940	
		Supron Energy Corp.	640	1,938	
		Private Individuals	1,341		
RENO-CARSON CITY	Steamboat Springs	Earth Power Corp.	1,011		1
		Gulf Mineral Resources Co.	2,028		
		Pacific Energy Corp.	2,559	1,548	
		Phillips Petroleum & Gulf Oil Corp. Private Individuals	3,403		
DIXIE VALLEY	Dixie Valley	Amax Exploration, Inc.	16,021		
		Atlantic Richfield Co.	14,996		
		Champlin Petroleum Co.	5,104	27,892	
		Geothermal Resources International	7,998	2,560	
		Getty Oil Co.	7,712		
		J. W. Hughes & Southland Power Co.	2,559		
		Hughes, et. al. and Sunoco Energy Develop- ment Corp.	5,121		
		MCR Geothermal Corp.	12,789		

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STATE: NEVADA

TABLE 14 (Concluded)
LANDS LEASED AND/OR EXPLORED

REGION	AREAS/SITES INCLUDED	LEASEHOLDER*/ DEVELOPER	ACREAGE LEASED		DEEP WELLS
			Non-Competitive	Competitive	
DIXIE VALLEY (Continued)		Mobil Oil Corp.	5,066		2
		O'Brien Resources Corp.	36,631		
		Occidental Geothermal, Inc.	5,119		
		Onaping Energy & Resources, Inc.	4,085		
		Phillips Petroleum Co.	12,752		
		Quest Energy Ltd.	3,813		
		Republic Geothermal, Inc.	1,280	13,523	
		Southland Royalty Co.	11,253		
		Southland Royalty Co. & Champlin Petroleum	2,559		
		Southland Royalty Co. & Thermal Power Co.	8,798	1,600	
		Southland, Thermal Power & J.W. Hughes	4,477		
		Sunoco Energy Develop- ment Co.	9,870		
		Supron Energy Corp.	3,806		
		Union Oil of Calif.	1,280		
		Private Individuals	124,129		
OTHER	Wabuska HS (Lyon County) Hawthorne (Mineral County)		No Active Federal Leases		

BEST DOCUMENT AVAILABLE

3 >

STATE: NEVADACode: UC[#] - Under Construction
PR - Proposed
OP - Operating
U - Unknown

TABLE 15

ELECTRIC POWER AND DIRECT USE DEVELOPMENT ACTIVITY

REGION	AREAS/SITES INCLUDED	DEVELOPER	UTILITY	STATUS	MWe	ANNUAL BTU EQUIV ($\times 10^9$)	YEAR ON LINE/ OPERATIONAL
DESERT VALLEY	Humboldt	Unknown (Space Heat)	-	OP	-	1	U
		Nevada Green	-	OP	-	.5*	1979
		Desert Research Institute	-	PR	-	60*	U
STILLWATER MOUNTAINS	Brady-Hazen	Geothermal Food Processors	-	PR	-	600*	1982
		Grace Geothermal	-	PR	-	600*	1982
		Geothermal Food Processors	-	OP	-	160	1979
	Stillwater	Unknown (Space Heat)	-	OP	-	1	1912
CRESCENT VALLEY	Beowawe	Half Circle Ranch	-	PR	-	30	U
RENO-CARSON CITY	Steamboat Springs	ABC Concrete Production	-	UC	-	100*	U
		Double Diamond Development	-	UC	-	5*	1981
		Unknown (District Heating)	-	PR	-	5*	U
		Unknown	-	OP	-	.5	U
		Unknown	-	OP	-	.2	1979
		City of Reno	-	PR	-	5*	U
		Damonte Ranch	-	PR	-	1200*	U
		Double Diamond Development	-	UC	-	1600*	1982
		Hydrothermal Energy Corporation	-	UC	-	5*	1981
		MGM Grand Hotel	-	UC	-	100*	U
		Moana Pool	-	OP	-	.5*	U
		The Pepper Mill	-	OP	-	1*	U

*Annual energy use is a rough estimate.

#For direct heat projects, construction begins with preliminary development activities such as exploratory drilling.

BEST DOCUMENT AVAILABLE

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STATE: NEVADA

TABLE 15 (Concluded)

ELECTRIC POWER AND DIRECT USE DEVELOPMENT ACTIVITY

REGION	AREAS/SITES INCLUDED	DEVELOPER	UTILITY	STATUS	MWe	ANNUAL BTU EQUIV. (x 10 ⁹)	YEAR ON-LINE/ OPERATIONAL
RENO-CARSON CITY (Continued)	Steamboat Springs	Unknown (Space Heating)	-	OP	-	15*	U
		Veterans Hospital	-	PR	-	1*	U
		Warren Properties	-	UC	-	32*	U
		Explosives Engineering	-	OP	-	5*	U
		Mark Twain Motel	-	OP	-	.5*	U
		Unknown	-	OP	-	1	U
DIXIE VALLEY	Dixie Valley	Phillips Petroleum	Northern Nevada Utility Group	PR	10	-	1982
OTHER	Wabuska Hot Springs	Alexander Dawson Company	-	PR	-	60*	U
		Tad's Enterprises	-	OP	-	24*	1980
Total, Operating					-	210.2	
Total, Other					10	4403	

BEST DOCUMENT AVAILABLE

Leasing and exploration activity is shown in Table 16.

Direct Heat Applications

Principal direct heat uses in New Mexico are commercial and residential space and water heating, and greenhousing. Three space heating projects are currently in use, two in Truth or Consequences at the Carrie Tingley Hospital and the Yucca Lodge and one at a 10-story bank building in Albuquerque. Commercial and residential space heating projects are under construction at Las Cruces and Truth or Consequences. These include a project to heat twelve buildings on the campus of New Mexico State University at Las Cruces, for which four wells have already been drilled, and space and water heating for a senior citizens' center in Truth or Consequences, where drilling has started. In addition, eight residential heating projects are proposed in Albuquerque, West Mesa, Las Cruces, and Truth or Consequences. Elsewhere in the state, three greenhouses are currently using geothermal heat in the Animas Valley and their developers/owners are proposing expansion of their geothermal operations.

Electric Power Development

In the Baca location No. 1 KGRA (Valles Caldera), a 50 MWe demonstration electric power plant is proposed. The project is being funded by the Department of Energy, Union Oil of California and the Public Service Company of New Mexico. Well drilling for this project is continuing but plant construction is currently suspended until Union Oil demonstrates its ability to produce an adequate supply of steam for the facility. Power on line is scheduled for 1984.

Electric power and direct heat projects are summarized in Table 17.

Recent Major Activities

● New Mexico Bill to Halt PSC Review of Small Test Plants

A bill introduced in the New Mexico state legislature early this year would prevent the State Public Service Commission (PSC) from reviewing small demonstration power plants, possibly including the Baca geothermal project. The bill provides that "demonstration" plants or those "using new technology and producing no more than 50 MWe of power" will be reviewed only by the Environmental Improvement Division for air and water pollution controls. Though the PSC has completed hearings on the controversial Baca project, the case has not been settled and could possibly be affected by the legislation if enacted.

Source: Albuquerque Journal, 2/20/81

● Geothermal Non-Proliferation Bill Rejected

Another bill introduced in the state legislature was rejected by the Senate. This bill, which sought to prevent proliferation of geothermal power plants in the scenic Jemez Mountains, would have temporarily limited expansion of the 50 MWe power project at Baca.

Source: Albuquerque Journal, 3/6/81.

● Funding Proposed for NMSU Demonstration Project

A bill before the New Mexico state legislature requests \$29,000 for a geothermal demonstration project proposed for New Mexico State University at Las Cruces. The funds would be combined with \$125,000 from the state Energy and Minerals Department and \$336,000 from the U.S. DOE. The total project cost is estimated at \$1.29 million. The funds would be used to complete the University's geothermal direct use project. The New Mexico legislature has appropriated about \$2 million a year for the past seven years to promote geothermal development in the state. If the current bill is approved, the project will use two geothermal wells on campus to supply space heating for eleven buildings and an outdoor pool.

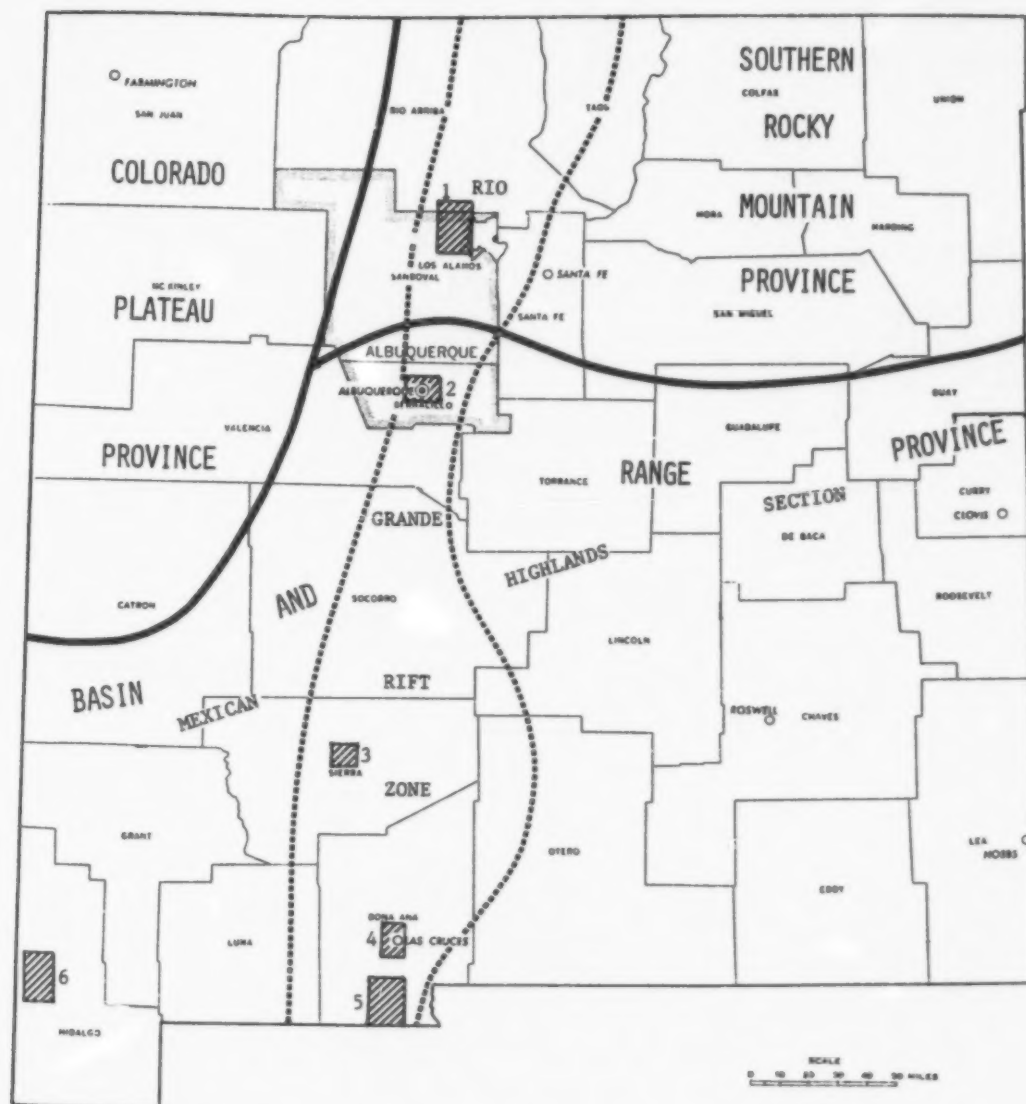
Sources: GRC Bulletin, 5/81 PIC NGS, 3/13/81.

NORTH DAKOTA

High-temperature resources are not known to exist in North Dakota, though several direct heat projects using lower-temperature resources have been proposed.

Leasing and Exploration

The principal geothermal resource area in North Dakota is identified on the map in Figure 10.



- Principal Geothermal Areas**
1. Baca Location No. 1 KGRA
 2. Albuquerque Direct Heat Project
 3. Truth or Consequences Direct Heat Project
 4. Las Cruces Direct Heat Project
 5. Kilborne Hole KGRA
 6. Lightning Dock KGRA

LEGEND

⊙ Places of 100,000 or more inhabitants
 ○ Places of 25,000 to 50,000 inhabitants outside SMSA's

Standard Metropolitan Statistical Areas (SMSA's)
 Population data as of July 1975. SMSA definitions as of June 1977

Figure 9
 Principal Geothermal Resource Areas in New Mexico

BEST DOCUMENT AVAILABLE

STATE: NEW MEXICO

TABLE 16
LANDS LEASED AND/OR EXPLORED

REGION	AREAS/SITES INCLUDED	LEASEHOLDER*/ DEVELOPER	ACREAGE LEASED		DEEP WELLS#
			Non-Competitive	Competitive	
MEXICAN HIGHLANDS	Lightning Dock KGRA	Amax/Earth Power Amax Exploration Aminoil Chevron USA Earth Power Livingston International Sunedco Thermal Resources, Inc. United States Geothermal Corporation	2,989 5,814 534 1,718 2,560 464 1,285	1,885 6,580 1,711 3,175	
MEXICAN HIGHLANDS/ RIO GRANDE RIFT	Kilbourne Hole KGRA Las Cruces Truth or Consequences Albuquerque	Private Individuals	7,206		
SOUTHERN ROCKY MOUNTAINS/RIO GRANDE RIFT	Baca Location No. 1 KGRA (Valles Caldera)	Amax Aminoil USA Phillips Petroleum Union Oil		10,054 10,481 5,090	13

* Federal lands only

#Wells over 2000 feet known to be producible.

BEST DOCUMENT AVAILABLE

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STATE: NEW MEXICO

Code: UC[#] - Under Construction
 PR - Proposed
 OP - Operating
 U - Unknown

TABLE 17

ELECTRIC POWER AND DIRECT USE DEVELOPMENT ACTIVITY

REGION	AREAS/SITES INCLUDED	DEVELOPER	UTILITY	STATUS	MWe	ANNUAL BTU EQUIV. (x 10 ⁹)	YEAR ON-LINE/ OPERATIONAL
MEXICAN HIGHLANDS/ RIO GRANDE RIFT	Las Cruces	Amdec Corporation	-	PR	-	5*	1981
		City of Las Cruces	-	PR	-	5*	U
		Mesilla Valley Mall	-	UC	-	400	1981
		New Mexico State University	-	UC	-	400	U
	Truth or Consequences	Carrie Tingley Hospital	-	OP	-	2	1980
		Geronimo Springs Museum	-	UC	-	1*	U
		Karl Kortmeier	-	UC	-	2	U
		Randy Asbaugh	-	PR	-	5*	U
		Senior Citizens Center	-	UC	-	.2	1981
		Yucca Lodge	-	OP	-	1	U
	Albuquerque	Sandia Savings	-	OP	-	5	U
		University of New Mexico	-	PR	-	770	U
		High school	-	PR	-	1*	U
		Residential Heating District	-	PR	-	5*	U
		University of Albuquerque	-	PR	-	52	U
		West Mesa Apartments	-	PR	-	1*	U
	Lightning Dock KGRA/Animas Valley	Burgett Floral	-	OP	-	12	1978
		Burgett Floral	-	PR	-	600	1984
		Tom McCants	-	OP	-	.5	1967
		Tom McCants	-	UC	-	12	1981
		Unknown	-	OP	-	101*	U
		Unknown	-	PR	-	600*	U

BEST DOCUMENT AVAILABLE

43

STATE: NEW MEXICO

Code: UC[#] - Under Construction
 PR - Proposed
 OP - Operating
 U - Unknown

TABLE 17 (Concluded)

ELECTRIC POWER AND DIRECT USE DEVELOPMENT ACTIVITY

REGION	AREAS/SITES INCLUDED	DEVELOPER	UTILITY	STATUS	MWe	ANNUAL BTU EQUIV. ($\times 10^9$)	YEAR ON LINE/ OPERATIONAL
COLOPADO PLATEAU/ RIO GRANDE RIFT	Baca Location No. 1 KGRA (Valles Caldera)	Union Oil	-	PR	50	-	U
Total, Operating					-	121.5	
Total, Other					50	2859.2	

* Annual energy use is a rough estimate.

#For direct heat projects, construction begins with preliminary development activities such as exploratory drilling.

BEST DOCUMENT AVAILABLE

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As yet, no federal lands have been leased for geothermal development, and there are no completed deep geothermal wells.

Direct Heat Applications

Five projects have been proposed in the Bismarck area, most of which are for residential and commercial space heating, including heating of the central business district. A local ski resort is considering using the geothermal energy for making snow. These projects are listed in Table 18.

OREGON

Geothermal resources have been used in Oregon since the turn of the century, primarily for heating of residences in Klamath Falls. The state is taking new interest in its geothermal resources, and has formed an alternative energy commission, which has initiated a statewide planning program. The Alvord Valley and Crump Geysers areas have received attention by industry in the last year, marked by the sale of competitive leases in the area.

Leasing and Exploration

Although there are many geothermal resource areas in the state of Oregon (Figure 11), no deep producible wells have been completed.

Major leaseholders in Oregon are Amax, the Rosewood Corp., California Geothermal, Placer Amex, Anadarko, and Getty Oil. Principal competitive leaseholders are Anadarko, Getty Oil, and Chevron USA. Most of the competitive leases are in the Alvord and Crump Geysers KGRAs. Table 19 summarizes the leasing activity in the state.

Direct Heat Applications

Geothermal direct heat is being used in Oregon for residential and district heating, greenhousing and aquaculture, ethanol production and various other industrial processes.

The city of Klamath Falls has used geothermal resources for heating of residences since 1900; geothermal direct uses in the Klamath Falls area have since been expanded to include heating of more residences, commercial buildings, greenhouses, prawn raising and snow melting. Projects currently in operation in Klamath Falls include nine separate residential and commercial space heating projects, two greenhouses, two prawn-raising ventures, and snow melting on state roads. Projects to provide space heating to an elementary school and additional district heating to the city are currently under construction. Proposed projects include seven more residential/commercial space heating projects, an ethanol plant, and a sewage treatment plant.

Lakeview is using geothermal resources for greenhouse heating and aquaculture. A project to heat 71 downtown buildings and an industrial park is currently under construction. In addition, five projects have been proposed, including an ethanol plant and a wood chip drying operation.

Vale Hot Springs and nearby Adrian are now operating two ethanol plants and heating a YMCA. Homeowners have been using geothermal resources for heating since 1940. Another ethanol plant at Vale Hot Springs is proposed, as are agricultural and industrial process heat projects by a mushroom producing firm and a cattle company.

Four projects, including an ethanol plant, are in operation at Hot Lake and Medical Hot Springs in the Central Highlands region; the town of La Grande is proposing three separate commercial and residential space heating projects.

These projects are detailed in Table 20.

SOUTH DAKOTA

South Dakota's resources are in the low- to moderate-temperature range. They are being used for several direct heat applications.

Leasing and Exploration

A deep producible well has been completed at each of the principal geothermal areas in South Dakota (Figure 12, Table 21). Currently, there are no federal leases in the state.

Principal Geothermal Resource Areas in North Dakota

Figure 10



BEST DOCUMENT AVAILABLE

STATE: NORTH DAKOTA

Code: UC - Under Construction
 PR - Proposed
 OP - Operating
 U - Unknown

TABLE 18

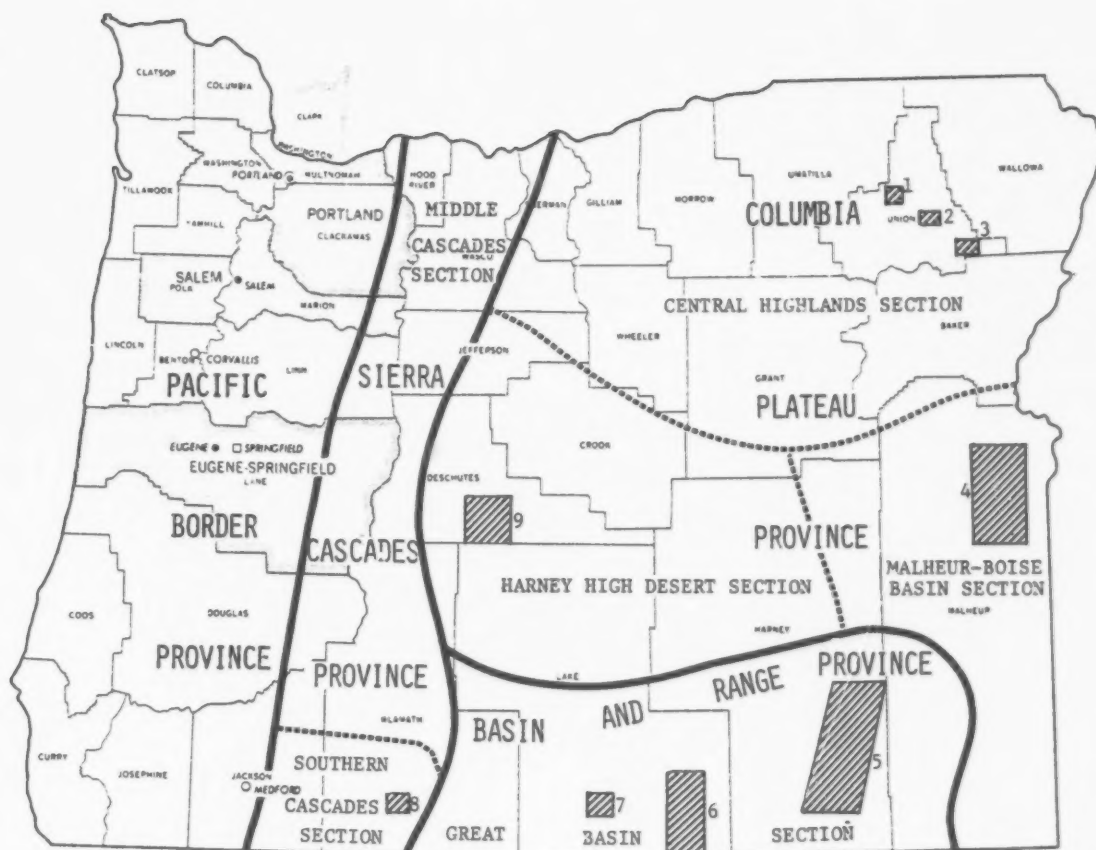
ELECTRIC POWER AND DIRECT USE DEVELOPMENT ACTIVITY

REGION	AREAS/SITES INCLUDED	DEVELOPER	UTILITY	STATUS	MWe	ANNUAL BTU EQUIV. (x 10 ⁹)	YEAR ON LINE/ OPERATIONAL
NORTHERN GREAT PLAINS	Bismarck	Carlson Homes	-	PR	-	.4*	1981
		Downtown Merchants Association	-	PR	-	.5*	U
		Patterson Place	-	PR	-	7.3	U
		Twilight Hills Ski Bowl	-	PR	-	1	U
		Joe Latey	-	PR	-	.2	U
Total Operating					-	-	
Total, Other					-	13.9	

* Annual energy use is a rough estimate.

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Principal Geothermal Areas

1. La Grande Direct Heat Project
2. Hot Lake Direct Heat Project
3. Medical Hot Springs Direct Heat Project
4. Vale Hot Springs KGRA/Adrian Direct Heat Project
5. Alvord Valley KGRA
6. Crump Geyser KGRA
7. Lakeview Direct Heat Project
8. Klamath Falls Direct Heat Project
9. Newberry Caldera

LEGEND

- Places of 100,000 or more inhabitants
- Places of 50,000 to 100,000 inhabitants
- SMSA central cities with fewer than 50,000 inhabitants
- Places of 25,000 to 50,000 inhabitants outside SMSA's



Standard Metropolitan
Statistical Areas (SMSA's)

Population data as of July 1975. SMSA definitions as of June 1977.

SCALE
0 10 20 30 40 50 MILES

Figure 11

Principal Geothermal Resource Areas in Oregon

BEST DOCUMENT AVAILABLE

STATE: OREGON

TABLE 19
LANDS LEASED AND/OR EXPLORED

REGION	AREAS/SITES INCLUDED	LEASEHOLDER*/ DEVELOPER	ACREAGE LEASED		DEEP WELLS
			Non-Competitive	Competitive	
CENTRAL HIGHLANDS	La Grande Hot Lake Medical H.S.		No Active Federal Leases		None
HIGH LAVA PLATEAU/ MALHEUR-BOISE BASIN	Vale H.S. Adrian	Amax Exploration Amax/Earth Power California Geothermal Chevron USA Earth Power Geothermal Resources International Hassie Hunt, Inc. Republic Geothermal Rosewood Corporation Thermal Resources, Inc. Union Oil United States Geothermal Utah International Private Individuals	16,696 9,434 11,571 5,428 6,674 5,994 5,120 19,700 6,872 560 5,362 2,687 44,930	 2,560 1,347 8,011	
HIGH LAVA PLATEAU/ HARNEY HIGH DESERT	Newberry Caldera	Aminoil USA California Geothermal Francana Resources	14,436 32,469 2,635		
GREAT BASIN	Alvord Valley KGRA Crump Geyser KGRA Lakeview	Al-Aquitaine Exploration Anadarko Production California Geothermal Chevron USA Delta Funds Inc. Getty Oil Hassie Hunt Exploration Hunt Oil Placer Amex, Inc. Supron Energy Thermal Resources, Inc. Utah International Private Individuals	 2,541 1,908 3,520 3,193 645 2,492 19,521 4,532 1,680 2,680 40,350	7,480 12,223 9,331 11,661 4,715 2,560	
SOUTHERN CASCADES	Klamath Falls	Hassie Hunt Exploration Private Individuals	2,770 8,407		

* Federal lands only.

BEST DOCUMENT AVAILABLE

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STATE: OREGON

Code: UC[#] - Under Construction
 PR - Proposed
 OP - Operating
 U - Unknown

TABLE 20

ELECTRIC POWER AND DIRECT USE DEVELOPMENT ACTIVITY

REGION	AREAS/SITES INCLUDED	DEVELOPER	UTILITY	STATUS	MWe	ANNUAL BTU EQUIV (x 10 ⁹)	YEAR ON-LINE/ OPERATIONAL
CENTRAL HIGHLANDS	La Grande	City of La Grande	-	PR	-	5*	U
		Grande Ronde Hospital	-	PR	-	1*	U
		City of La Grande	-	PR	-	5*	U
	Hot Lake	Burt Courtwright	-	OP	-	1	1960
		Grande Ronde Commodities	-	OP	-	120*	1980
		S. Manson	-	OP	-	1	1890
	Medical Hot Springs	N. Faye	-	OP	-	.7	1930
HIGH LAVA PLATEAU/ MALHEUR-BOISE BASIN	Vale Hot Springs KGRA	J. A. Albertson Land & Cattle	-	PR	-	1*	U
		Oregon Trail Mushrooms	-	PR	-	480	U
		Private Homeowners	-	OP	-	1	1940
		Private Homeowners	-	OP	-	4	1950
		Renewable Energy, Inc.	-	PR	-	270*	1982
		Willis Brown	-	OP	-	120*	1981
	Adrian	Owyhee Energy Producers	-	OP	-	36*	1981
		YMCA	-	OP	-	.5*	U
GREAT BASIN	Lakeview	Crystal Clear Energy	-	PR	-	60*	1981
		Northwest Geothermal	-	UC	-	5*	1986
		Oregon Desert Farms	-	OP	-	1	1970
		Pacific Wood Fuel	-	PR	-	100	U
		Town of Lakeview	-	PR	-	.5*	1983

*Annual energy use is a rough estimate.

#For direct heat projects, construction begins with preliminary development activities such as exploratory drilling.

BEST DOCUMENT AVAILABLE

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STATE: OREGON

TABLE 20 (Continued)

ELECTRIC POWER AND DIRECT USE DEVELOPMENT ACTIVITY

REGION	AREAS/SITES INCLUDED	DEVELOPER	UTILITY	STATUS	MWe	ANNUAL BTU EQUIV. ($\times 10^9$)	YEAR ON-LINE/ OPERATIONAL
GREAT BASIN	Lakeview	Unknown	-	OP	-	100*	U
		Unknown (District Heating)	-	PR	-	5*	U
		Unknown	-	PR	-	5*	U
SOUTHERN CASCADES	Klamath Falls	Apartment Complex	-	PR	-	2*	U
		City of Klamath Falls	-	UC	-	35	1981
		City of Klamath Falls	-	PR	-	25	U
		Diverse Community Businesses	-	OP	-	.7	1945
		Fairview Elementary School	-	PR	-	.5*	U
		High Valley Services, Inc.	-	PR	-	1*	U
		Homeowners	-	OP	-	14	1900
		Indian Rock Greenhouses	-	OP	-	5*	1980
		Keenan Smith	-	OP	-	2	1979
		Kingwood Apartments	-	OP	-	6	1960
		Klamath County	-	OP	-	1*	U
		Klamath County YMCA	-	OP	-	5	1980
		Klamath Falls School District	-	OP	-	9	1974
		Klamath Lutheran Church	-	PR	-	1*	U
		Liskey Farms	-	OP	-	2	1978
		Medo-Bel Creamery	-	OP	-	100*	U
		Merle West Medical Center	-	OP	-	.5	1974
		Modoc Lumber Company	-	PR	-	100*	U
		Mountain View Professional Building	-	OP	-	1*	1981
		Oregon Department of Higher Education	-	OP	-	7	1963

STATE: OREGON

TABLE 20 (Concluded)

ELECTRIC POWER AND DIRECT USE DEVELOPMENT ACTIVITY

REGION	AREAS/SITES INCLUDED	DEVELOPER	UTILITY	STATUS	MWe	ANNUAL BTU EQUIV. (x 10 ⁹)	YEAR ON-LINE/ OPERATIONAL	
SOUTHERN CASCADES	Klamath Falls	Oregon Institute of Technology	-	OP	-	1*	U	
		Pelican School	-	PR	-	1*	U	
		Sewage Treatment Plant	-	PR	-	100*	U	
		Shasta Elementary School	-	UC	-	1*	U	
		State of Oregon	-	OP	-	10*	1950	
		Klamath Energy, Inc.	-	PR	-	72*	1982	
Total, Operating					-	549.4		
Total, Other					-	1276		

BEST DOCUMENT AVAILABLE

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Direct Heat Applications

Geothermal direct heat is being used primarily for residential and commercial space heating in South Dakota. In the city of Philip, four projects are in operation, which include heating of five school buildings and a manufacturing plant and providing industrial process heat to a water treatment facility. Public school buildings in Midland are also being heated geothermally. St. Mary's Hospital in Pierre has used geothermal energy for space heating since last year. Proposed uses in Pierre include heating of the Capitol Mall, greenhouse heating, and a project to heat 200 residences. Finally, the town of Lemmon is proposing a multiple-use project which would include district heating, ethanol production, grain drying, and greenhouse heating, with estimated annual use of over one trillion Btus. Projects are summarized in Table 22.

TEXAS

Though Texas has extensive geopressured geothermal resources from which methane recovery may be feasible in the next few years, geothermal development there is currently limited to direct heat applications of low-temperature geothermal waters.

Leasing and Exploration

A total of three deep producible wells have been completed at the principal geothermal areas in Texas (Figure 13, Table 23). There are no active federal leases in the identified resource areas.

Direct Heat Applications

Five geothermal space and district heating projects are proposed or under construction. Space heating systems for Torbett-Hutchins-Smith Memorial Hospital in Martin and Navarro College and Hospital in Corsicana are currently under development. These projects are summarized in Table 24.

UTAH

Utah contains primarily moderate-temperature resources suitable for direct heat applications, although there is a high-temperature resource in the Roosevelt Hot Springs KGRA in the southern part of the state. Utah is beginning to look at ways of developing this resource potential and has recently passed new legislation to help enhance beneficial use of geothermal resources in the state.

Leasing and Exploration

The principal geothermal resource areas in the state of Utah are identified in Figure 14. Two deep producible wells have been completed in the state (Table 25).

The greatest amount of land under competitive lease is held by Phillips Petroleum in the Roosevelt Hot Springs area. Other major competitive leaseholders are Amax, Union, Mother Earth Industries, and Aminoil USA. The principal leaseholders overall are Atlantic Richfield, Phillips, and Chevron USA. Most of the leases are in the Great Basin region, which includes Roosevelt Hot Springs, site of a proposed 50 MWe power plant.

Direct Heat Applications

Most of the direct heat projects in Utah are in the Crystal Hot Springs area, where geothermal direct heat is being used for tropical fish raising and heating of two greenhouses. A project to heat the Utah Prison is currently under construction and a space heating project for a convalescent facility has been proposed. A geothermally-heated spa is in operation in the Sevier area, where a residential district heating project is also under construction by Monroe City. In the Cove Fort-Sulphurdale KGRA, R&R Energies is building a 7 million gallon-a-year geothermal ethanol plant.

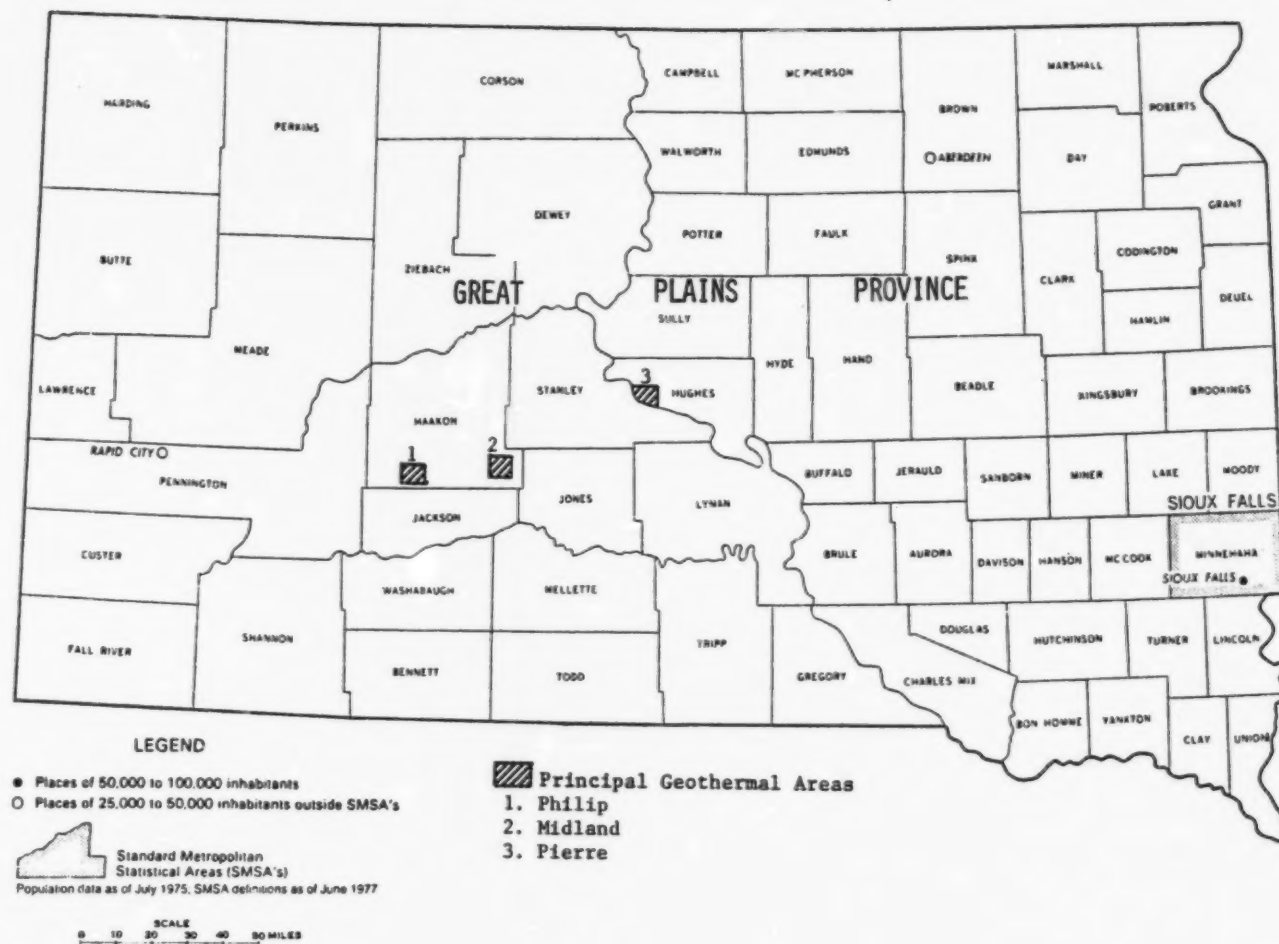
Electric Power Development

In the Roosevelt Hot Springs KGRA near Milford in Beaver County, the Utah Power and Light Company, in conjunction with Phillips Petroleum, is planning to build three geothermal electric power plants. A 20 MWe unit is expected to come on line in 1984. Two 50 MWe units will follow.

Roosevelt Hot Springs is also the site of an upcoming DOE/EPRI field test of a new rotary separator turbine.

Principal Geothermal Resource Areas in South Dakota

Figure 12



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STATE: SOUTH DAKOTA

TABLE 21
LANDS LEASED AND/OR EXPLORED

REGION	AREAS/SITES INCLUDED	LEASEHOLDER / DEVELOPER	ACREAGE LEASED		DEEP WELLS [#]
			Non-Competitive	Competitive	
GREAT PLAINS	Philip	Haakon School District	No Active Federal Leases		1
	Midland	St. Mary's Hospital			1
	Pierre	Diamond Ring Ranch			1

[#]Wells over 2000 feet known to be producible.

BEST DOCUMENT AVAILABLE

STATE: SOUTH DAKOTACode: UC - Under Construction
PR - Proposed
OP - Operating
U - Unknown

TABLE 22

ELECTRIC POWER AND DIRECT USE AND DEVELOPMENT ACTIVITY

REGION	AREAS/SITES INCLUDED	DEVELOPER	UTILITY	STATUS	MWe	ANNUAL BTU EQUIV. (x 10 ⁹)	YEAR ON LINE/ OPERATIONAL
GREAT PLAINS	Lemmon	Town of Lemmon	-	PR	-	1,014	U
	Haakon City	Diamond Ring Ranch	-	OP	-	7.9	1980
	Midland	City of Midland	-	OP	-	5	1968
	Philip	City of Philip	-	OP	-	5	1970
		Haakon School District	-	OP	-	9.5	1980
		Little Scotchman Industries	-	OP	-	1	U
		Unknown (Water Treatment Plant)	-	OP	-	100	1965
		Nine Local Businesses	-	PR	-	7	U
	Pierre	Capitol Mall	-	PR	-	3	U
		Pierre Flower Shop	-	PR	-	1.5	U
		Ray Shields	-	PR	-	40	U
		St. Mary's Hospital	-	OP	-	11.4	1980
	Total, Operating				-	139.8	
	Total, Other				-	1,065.5	

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- Principal Geothermal Areas**
1. Falls County/T-H-S Memorial Hospital
 2. Navarro County/Navarro College

Figure 13

Principal Geothermal Resource Areas in Texas

STATE: TEXAS

TABLE 23
LANDS LEASED AND/OR EXPLORED

REGION	AREAS/SITES INCLUDED	LEASEHOLDER / DEVELOPER	ACREAGE LEASED		DEEP WELLS #
			Non-Competitive	Competitive	
COASTAL PLAIN	Marlin	Torbett Hutchins-Smith Memorial Hospital	No Active Federal Leases		1
	Corsicana	Navarro College			2

#Wells over 2000 feet known to be producible.

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STATE: TEXAS

Code: UC[#] - Under Construction
 PR - Proposed
 OP - Operating
 U - Unknown

TABLE 24

ELECTRIC POWER AND DIRECT USE DEVELOPMENT ACTIVITY

REGION	AREAS/SITES INCLUDED	DEVELOPER	UTILITY	STATUS	MWe	ANNUAL BTU EQUIV. (x 10 ⁹)	YEAR ON LINE/ OPERATIONAL
COASTAL PLAIN	Marlin	Chamber of Commerce	-	PR	-	1*	U
		City of Marlin	-	PR	-	5*	U
		T.H.S. Memorial Hospital	-	UC	-	11	1982
	Corsicana	Navarro College and Hospital	-	UC	-	35	1982
		Texas Ethanol Corp.	-	PR	-	1800	1983
		Total, Operating				-	-
	Total, Other				-	1852	

* Annual energy use is estimated.

[#] For direct heat projects, construction begins with preliminary development activities such as exploratory drilling.

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Electric power and direct heat projects are summarized in Table 26.

Recent Major Activities

● Geothermal Bill Passed

A bill establishing procedures and regulation guidelines for development of Utah's geothermal energy has been passed by the state legislature. The Geothermal Conservation Act grants authority over geothermal resources to the Division of Water Rights, defines the resource, and includes provisions for the protection of correlative rights, prevention of waste, and authorization and procedures for using geothermal areas. Under the Utah law, geothermal energy is defined as temperatures in the earth above 120°C (245°F).

Source: GRC Bulletin, Feb./Mar. 1981, Jan. 1981.

● Hunt Oil Takes Leases in State Sale

Hunt Oil was the sole bidder at a geothermal lease sale held March 30, 1981 by the Utah Department of Natural Resources. The company took all the acreage up for bid -- approximately 1919 acres in Beaver and Millard counties -- and paid a total bonus of \$6715.35. The Beaver County leases are within 18 miles southwest of the Roosevelt Hot Springs KGRA; the Millard County leases are some 25 miles north of that KGRA.

Source: PIC NGS, 4/3/81.

WASHINGTON

Some low- to moderate-temperature resources are known in Washington. These resources are being used for direct heat applications in some areas. The state has begun to investigate ways of enhancing its geothermal resource potential. Washington contains extensive National Forest Service lands, many of which are expected to be leased in the next year.

Leasing and Exploration

Most of the principal geothermal areas in the state of Washington are situated in the Cascade Mountain Range. Figure 15 is an index map of the principal locations.

No producible deep wells have been completed in the areas identified as having geothermal resource potential. Leaseholders are shown in Table 27.

Direct Heat Applications

The City of North Bonneville has started drilling for a commercial district heating project and is considering expanding the project to light industry process heating applications. The City of Ephrata has proposed use of geothermally-assisted heat pumps to heat 12 public housing units and a courthouse. These projects are summarized in Table 28.

Recent Major Activities

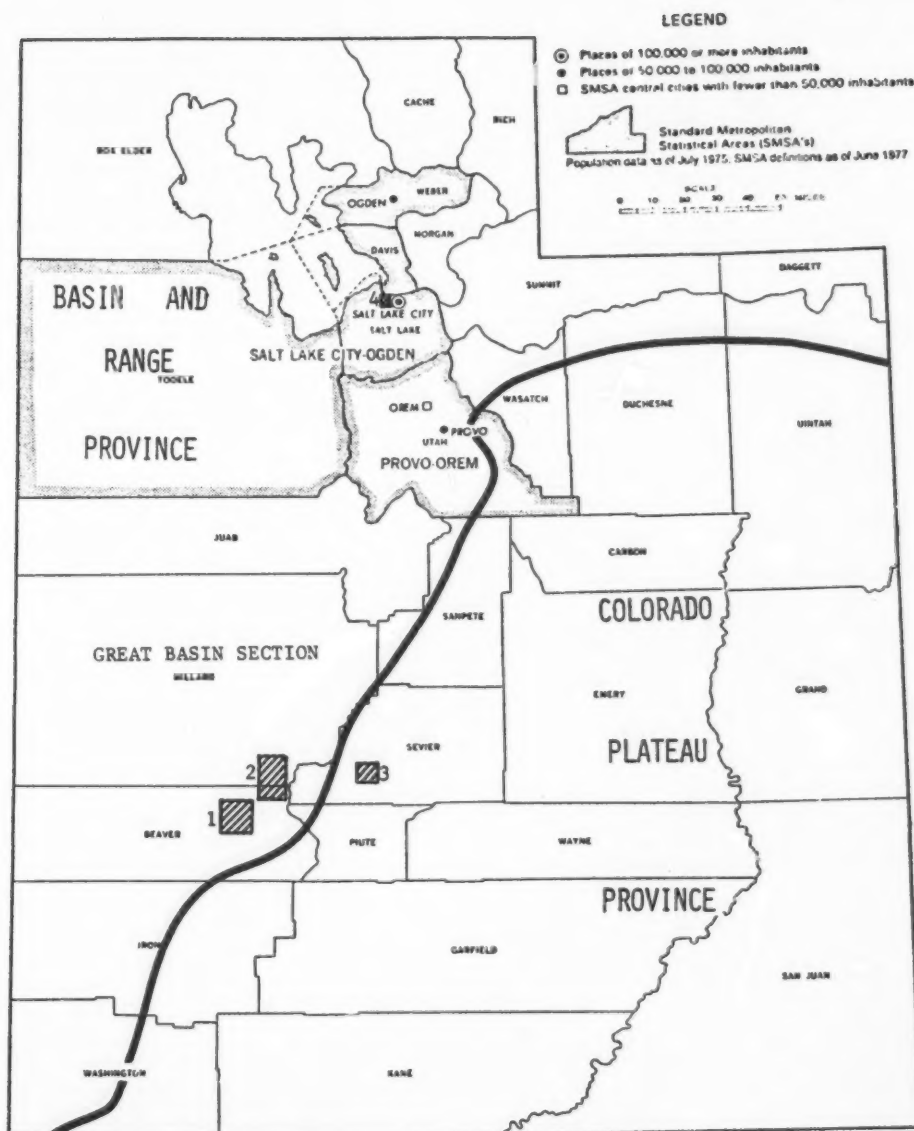
● Washington Bill Establishes Geothermal Revenue Fund

Washington state legislators have passed a bill requiring that revenue received from geothermal leases on federal lands be deposited into a state geothermal fund.

When U.S. Forest Service (USFS) or Bureau of Land Management (BLM) administered lands are leased for geothermal exploration and development, 50 percent of the lease fee is made available to the state. The newly passed legislation in the state of Washington provides that these funds be appropriated to the counties of origin to mitigate the social, economic and environmental impacts of geothermal development; to the Department of Natural Resources and Division of Geology and Earth Resources for continuing geothermal resource assessment; and to the Washington State Energy Office for expansion of its geothermal commercialization and development program. The legislation is similar to California's AB 1905, signed into law on May 30, 1980.

The U.S. Forest Service estimates that 148 lease applications in the state of Washington will receive final action during 1981. These initial leases, totaling approximately 350,000 acres, could result in \$150,000 to \$175,000 being made available for deposit into the state geothermal fund annually for five to ten years. The leasing of additional acreage will increase this amount, as will royalties that will become available after development of the geothermal leases.

Source: GRC Bulletin, 5/81.



Principal Geothermal Areas

1. Roosevelt Hot Springs KGRA
2. Cove Fort-Sulphurdale KGRA
3. Sevier Direct Heat Project
4. Crystal Springs

Figure 14

Principal Geothermal Resource Areas in Utah

STATE: UTAH

TABLE 25

LANDS LEASED AND/OR EXPLORED

REGION	AREAS/SITES INCLUDED	LEASEHOLDER*/ DEVELOPER	ACREAGE LEASED		DEEP WELLS
			Non-Competitive	Competitive	
GREAT BASIN	Roosevelt H.S. Cove Fort/Sulphurdale	Amax Exploration	2,660	3,085	
		American Geological Enterprises		1,843	
		Amoco Production Co.	1,923		
		Atlantic Richfield	20,383		
		Bow Valley Coal Resources	3,840		
		Chevron USA	9,629		
		Earth Power Corp.	2,560		
		Geothermal Exploration, Inc.	5,737		
		Geothermal Power Corp.	640		
		Getty Oil		1,920	
		Mother Earth Industries, Inc.		8,746	
		Mountain States Resources Corp.	1,946		
		O'Brien Resources	7,821		
		Phillips Petroleum	11,863	17,840	
		Plattsburgh Quarries, Inc.		40	
		Stewart Capital Corp.	2,520		
		Thermal Power of Utah	8,140		
		Thermal Resources, Inc.	2,109		
		Thermogenics, Inc.	6,220		
		Union Oil of Calif.		2,560	
		United States Geothermal Private Individuals	8,933 87,666	2,920	
	Crystal Springs	Utah Roses			1
WESTERN HIGH PLATEAUS	Sevier	Aminoil USA		4,066	
		Roosevelt H.S. Corp.	2,840		
		Thermex	707	2,572	
		Union Oil of Calif.	960		
		Private Individuals	1,920		

* Federal lands only.

#Wells over 2000 feet known to be producible.

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STATE: UTAH

Code: UC^g - Under Construction
 PR - Proposed
 OP - Operating
 U - Unknown

TABLE 26

ELECTRIC POWER AND DIRECT USE DEVELOPMENT ACTIVITY

REGION	AREAS/SITES INCLUDED	DEVELOPER	UTILITY	STATUS	MWe	ANNUAL BTU EQUIV ($\times 10^9$)	YEAR ON-LINE/ OPERATIONAL
GREAT BASIN	Roosevelt Hot Springs KGRA	Phillips Petroleum	Utah Power & Light Co.	PR	20		1984
		Phillips Petroleum	Utah Power & Light Co.	PR	50		U
		Phillips Petroleum	Utah Power & Light Co.	PR	50		U
	Cove Fort - Sulphurdale KGRA	R&R Energies	-	UC	-	420*	1981
	Crystal Hot Springs	G. Cox	-	PR	-	1	U
		Unknown	-	OP	-	3*	U
		Unknown	-	OP	-	.5*	U
		Utah Roses	-	OP	-	16*	1980
		Utah State Prison	-	UC	-	18	1982
WESTERN HIGH PLATEAUS	Sevier	Karl Meacham	-	OP	-	9	U
		Monroe City	-	UC		5*	1981
Total, Operating					-	30.5	
Total, Other					120	444	

*Annual energy use is estimated.

^gFor direct heat projects, construction begins with preliminary development activities such as exploratory drilling.

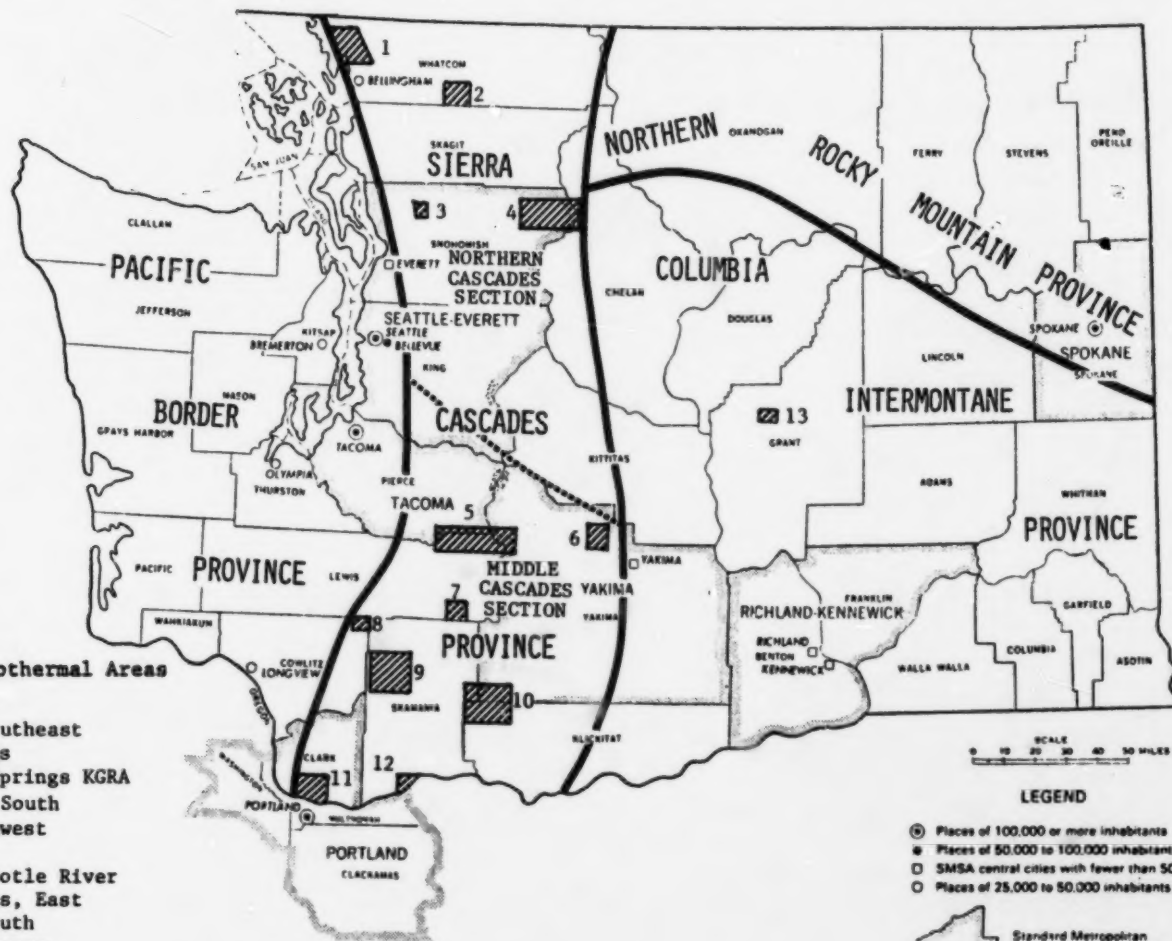
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Principal Geothermal Resource Areas in Washington

Figure 15

Principal Geothermal Areas

1. Bellingham
2. Mt. Baker, Southeast
3. Edward Springs
4. Kennedy Hot Springs KGRA
5. Mt. Rainier, South
6. Yakima, Northwest
7. Cispus River
8. North Fork Tootle River
9. Mt. St. Helens, East
10. Mt. Adams, South
11. City of Vancouver
12. North Bonneville
13. City of Ephrata



LEGEND

- Places of 100,000 or more inhabitants
- ⊙ Places of 50,000 to 100,000 inhabitants
- ⊖ SMSA central cities with fewer than 50,000 inhabitants
- Places of 25,000 to 50,000 inhabitants outside SMSA's

Standard Metropolitan Statistical Areas (SMSA's)
 Population data as of July 1975. SMSA definitions as of June 1977

STATE: WASHINGTON

TABLE 27

LANDS LEASED AND/OR EXPLORED

REGION	AREAS/SITES INCLUDED	LEASEHOLDER*/ DEVELOPER	ACREAGE LEASED		DEEP WELLS
			Non-Competitive	Competitive	
MIDDLE CASCADES	Mt. St. Helens/East Clear Creek Lewis River Pine Creek Spring 72 Lonesome Sale Road Spring Spring 710	Phillips Petroleum Atlantic Richfield	2,560 2,560		None
	Mt. Adams/South Indian Heaven KGRA Beal Creek Springs Gotchen Creek Springs Trout Lake Creek White Lake Creek White Creek White Salmon River Other Cispus River North Fort Toutle River City of Vancouver				
NORTHERN ROCKY MOUNTAINS	Ephrata		No Active Federal Leases		None

* Federal lands only.

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STATE: WASHINGTON

Code: UC# - Under Construction
 PR - Proposed
 OP - Operating
 U - Unknown

TABLE 28

ELECTRIC POWER AND DIRECT USE DEVELOPMENT ACTIVITY

REGION	AREAS/SITES INCLUDED	DEVELOPER	UTILITY	STATUS	None	ANNUAL BTU EQUIV ⁹ (x 10 ⁹)	YEAR ON LINE/ OPERATIONAL
NORTHERN ROCKY MOUNTAINS	Ephrata	City of Ephrata	-	PR	-	5	U
MIDDLE CASCADES	North Bonneville	City of N. Bonneville	-	UC	-	5	U
Total, Operating					-	-	
Total, Other					-	10	

[#] For direct heat projects, construction begins with preliminary development activities such as exploratory drilling.

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WYOMING

Wyoming contains no apparent high-temperature resources. Geothermal fluids are used for a few direct heat projects and by the enhanced oil recovery industry for water-flooding. The Wyoming state legislature has recently passed two bills which should encourage development of the state's geothermal resources.

Leasing and Exploration

The principal geothermal resource areas identified in the state of Wyoming are shown in Figure 16. There has been no leasing activity in these areas and no deep, producible wells have been completed.

Direct Heat Applications

Two geothermal direct use projects are currently in operation. One is an irrigation project at Midwest; the other is at Salt Creek, where Amoco has used geothermal water-flooding for enhanced oil recovery since 1964.

A private developer at Salt Creek has proposed use of geothermal energy for oil field operations and an ethanol plant. Other proposed projects include a multiple-use aquacultural, greenhousing, and district heating project at an industrial park in Midwest and district heating in the city of Thermopolis. A greenhouse heating system is under construction. These projects are summarized in Table 29.

Recent Major Activities

• State Legislature Passes Geothermal Bills

Two geothermal-related bills have been passed by the Wyoming state legislature. One of these bills (H.B. 282) authorizes leasing of state or school lands; the other (H.B. 283) amends Wyoming water law, specifying heat extraction as a "beneficial" use of water and defining geothermal resources as ground water. As such, their exploration, development, and use falls under the regulatory authority of the State Engineer.

Source: GRC Bulletin, 4/81.

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WYOMING

YELLOWSTONE NATIONAL PARK

Principal Geothermal Resource Areas in Wyoming

Figure 16



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STATE: WYOMING

TABLE 29

ELECTRIC POWER AND DIRECT USE DEVELOPMENT ACTIVITY

Code: UC# - Under Construction
 PR - Proposed
 OP - Operating
 U - Unknown

REGION	AREAS/SITES INCLUDED	DEVELOPER	UTILITY	STATUS	MWe	ANNUAL BTU EQUIV. (x 10 ⁹)	YEAR ON LINE/ OPERATIONAL
WYOMING BASIN	Thermopolis	Unknown	-	PR	-	1	U
		City of Thermoplis	-	PR	-	5	U
		Tom Berry	-	UC	-	1	U
	Midwest	R. James	-	PR	-	94	U
		Unknown	-	OP	-	5	U
	Salt Creek	Amoco et al.	-	OP	-	10,000	1964
		Private Developer	-	PR	-	100	U
	Total, Operating				-	10,005	
Total, Other					-	201	

For direct heat projects, construction begins with preliminary development activities such as exploratory drilling.

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II. RECENT MAJOR ACTIVITIES (GENERAL)

DIRECT HEAT

● HUD Announces Winners Under Joint HUD/DOE District Heating Solicitation

The Department of Housing and Urban Development has awarded district heating feasibility study grants to 28 communities. The cities of Berlin, Maryland; Santa Ana Pueblo, New Mexico; Thermopolis, Wyoming; and Union County, Oregon will focus on geothermal heating systems. Missoula, Montana and Provo, Utah will consider geothermal energy along with other sources such as waste wood burning. Awardees proposing heat pump applications include Bellows Falls, Vermont and Campbellsville, Kentucky. Springfield, Massachusetts will investigate feasibility of using heat pumps along with cogeneration.

Of the 600 cities expressing an interest in district heating, 110 submitted proposals and 35 of these proposed assessments of geothermal or heat pump systems. Although the majority of geothermal proposals came from states with a large known geothermal potential, proposals were also submitted by such nontraditional states as Vermont, Maryland, Kentucky, and Massachusetts.

Other cities selected were Albany, New York; Allentown, Pennsylvania; Atlanta, Georgia; Atlantic City, New Jersey; Baltimore, Maryland; Cambridge, Massachusetts; Columbus, Ohio; Dayton, Ohio; Devil's Lake, North Dakota; Ecorse, Michigan; Fort Wayne, Indiana; Galax, Virginia; Gary, Indiana; Holland, Michigan; Lawrence, Massachusetts; Lewiston, Maine; New York, New York; Norwalk, Connecticut; and Richmond, Indiana.

Funding for DOE Phase II, the design stage, has been delayed. Funding for the Phase II solicitation may be rescinded by Congress.

Source: GRC, 5/81.

LEASING

● USGS Sets Competitive Lease Sale Dates

The Conservation Division of the U.S. Geological Survey has set dates for competitive geothermal lease sales during 1981-1982. The selected leases in Known Geothermal Resource Areas that the agency plans to offer are as follows:

The Geysers, Coso Hot Springs, East Mesa, California, September 17, 1981.
East Brawley, Randsburg, California, October 1, 1981.
Gillard Hot Springs and Clifton, Arizona, October 1, 1981.
Mono-Long Valley, California, October 15, 1981.
Glass Mountain, California, November 19, 1981.
Beckwourth Peak, Lassen Hot Springs, California, December 10, 1981.
Indian Heaven, Washington, December 16, 1981.
Bodie, Ford Dry Lake, California, January 5, 1982.
Belknap-Foley Hot Springs, Carey Hot Springs, Oregon, February 24, 1982.
Newberry Caldera, Oregon, June 17 1982.
McCredie Hot Springs, Oregon, October 14, 1982.

All lease sale notices are tentative until public notice is issued 30 days prior to the sale.

Source: PIC NGS, 6/26/81.

● Federal Land Returned

The Department of the Interior (DOI) has revoked the withdrawal of about 680,000 acres of federal land at scattered sites in eleven western states. Each revocation restored the formerly withdrawn area to uses which had been prevented by the withdrawal. The action has been termed by the Interior Assistant Secretary for Land and Water Resources as a "positive move toward accelerated multiple use of....public land."

Source: The Geyser, 5/20/81.

● Hunts Active in Geothermal Leasing

Individuals, trusts, and corporations of the Texas Hunt family reportedly hold about one sixth of all federal land leased for geothermal exploration. Interior Department records show that the Hunts hold 252 of the 1600 geothermal leases which have been issued by the BLM, giving the family control of about 480,000 acres of the 2.9 million acres of federally leased geothermal land. Applications are pending for an additional 435,000 acres. Though the Hunts were thwarted in their

efforts to corner the market in soybeans and silver, they have avoided the federal limitation of 20,480 acres per state for an individual leaseholder by acquiring leases in 20 different names, including individuals, trusts, and corporations. Most of the Hunt investments have been made in noncompetitive leases in Nevada, New Mexico, Oregon, Idaho, and Utah. To date, they have reported no geothermal discoveries. An investigation of Hunt family activities by the House Subcommittee on Commerce, Consumer and Monetary Affairs has been expanded to include geothermal leasing activity.

Source: Washington Post, 3/1/81
Tribune, Oakland, CA, 3/1/81
Phoenix Republic, 3/2/81

OUTREACH AND TECHNICAL ASSISTANCE

• Technical Assistance Program Status Reported

The Division of Geothermal and Hydropower Technologies, Department of Energy supports a technical assistance program, whereby interested potential users of geothermal energy may receive up to 100 hours of technical and economic assistance. Technical assistance centers funded by DGHT are the Applied Physics Laboratory; EG&G, Idaho (Idaho National Engineering Laboratory); the Oregon Institute of Technology; Gruy Federal, Inc., and the University of Utah Research Institute. Assistance ranges from basic engineering evaluations to geothermal resource analyses. Information about assistance provided by one of these centers, EG&G, Idaho, is highlighted here.

From December 1980 through June 1981, EG&G, Idaho handled about 76 requests for technical assistance; 44 of these cases were new requests made during this period. A portion of these requests were completed by EG&G, Idaho; others were forwarded to subcontractors for consideration. Some cases were referred to the Moderate and Low Temperature Reservoir Engineering Program and to State Geothermal Commercialization Teams. Twenty-seven cases were completed by EG&G during this period. A summary of these cases by type of application follows.

EG&G, IDAHO COMPLETED TECHNICAL ASSISTANCE REQUESTS BY APPLICATION TYPE DECEMBER 1980 - JUNE 1981

MONTH	RESIDENTIAL SPACE HEAT	COMMERCIAL SPACE HEAT	AGRICULTURAL	INDUSTRIAL PROCESS HEAT	OTHER
December 1980	2	1	2	1	-
January 1981	-	2	-	-	1
February 1981	1	3	2	-	-
March 1981	-	-	-	-	-
April 1981	1	-	2	-	1
May 1981	1	-	2	-	-
June 1981	2	2	-	1	-
TOTAL	7	8	8	2	2

Source: EG&G Idaho, 7/81.

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LEGAL AND INSTITUTIONAL ACTIVITIES

● Geothermal Leasing Bills Introduced

Legislation to streamline federal geothermal leasing and permitting has been introduced in both houses of Congress. The bills are H.R. 4067, introduced by Rep. James Santini (Nevada), and S. 1516, sponsored by Senators James McClure (Idaho) and John Warner (Virginia). The two bills, similar in nature, are substantively supported by the Administration, but Department of Interior witnesses at a July hearing on the legislation stated that the Administration had not established a position on certain elements of H.R. 4067 relating to competitive leasing and lease readjustment intervals. As a result, action on the bill by both the House and the Senate has been indefinitely deferred.

Source: DOE, 10/9/81.

● Geothermal Tax Bills Introduced

Rep. Tony Hall (Ohio) and Sen. Riegle (Michigan) have introduced legislation to clarify the applicability of geothermal energy tax credits for residential and commercial applications. These bills (H.R. 4091 and S. 1684) would override IRS regulations which currently (1) limit the credits to systems using resources with temperatures of 50°C or higher and (2) prohibit application of the credits to systems which use geothermal energy in conjunction with another energy source (e.g. for peaking or topping). No action on the bills has been scheduled by the Ways and Means or Finance Committees.

Source: DOE, 10/9/81

● Geothermal Insurance Available

The Insurance Company of North America (INA) has formed a new insurance group providing comprehensive coverage to the energy industry. INA's Energy Insurance Group, based in Philadelphia, can provide insurance against the financial risk of geothermal reservoir failure, thus making a geothermal project a more attractive financial venture. Indemnification is based on the insured's loss resulting from resource inadequacy.

Source: DOE, 7/13/81.

RESEARCH AND DEVELOPMENT

● Nitrogen Drilling Fluids Reduce Corrosion

Results of a field study test of special drilling fluids indicate a marked decrease in drillpipe corrosion in geothermal wells. Sandia National Laboratories recently tested a nitrogen drilling fluid and compared results with a chemically treated drilling fluid at Union's Baca #22 at the Valles Caldera in New Mexico. Corrosion rates were reported as "10 times slower" using the nitrogen drilling fluid. Sandia is working to develop a portable generator which can produce nitrogen at the well site.

Source: EG&G Idaho, 7/14/81.

● Fenton Hill Operations Continue

Drilling equipment stuck in one of the wells at the Fenton Hill, New Mexico experimental hot dry rock site has been retrieved, leaving the hole apparently clear. Despite the long history of drilling problems and the risk of more failures, drilling will be resumed in hopes of reaching the target of approximately 50 MWt production from a man-made fracture system.

Source: DOE, 7/24/1981.

● Reservoir Stimulation at Baca Planned

Union is planning a massive hydraulic fracture of the Baca #20 well in August. At approximately 475°F, the 8000 bbl (plus 200,000 lbs. of proppant) treatment will be the hottest ever attempted.

Source: DOE, 7/24/81.

● Gravity Head Binary Project Continuation Sought

Sperry is pursuing negotiations with different utilities and Magma Power in hopes of finding a way to continue the gravity head binary project following loss of the special large diameter well at East Mesa. Since repairing the existing well does not appear to be a viable option, Sperry is seeking funds for drilling a new well, testing the turbine-pump unit and building and testing a complete gravity-head binary system. The program suffered a setback on June 22 when the liner recently cemented in the upper 1800 feet of the well collapsed, blocking the hole at a depth of about 400 feet.

ENVIRONMENT

- EIC H₂S Process Being Developed

The EIC Company is working on its copper sulfate H₂S abatement process to extend the applicability of the present process to a wider range of geothermal resources. They are changing the process chemistry to produce more valuable by-products.

Source: DOE, 7/24/81.

- Alternative H₂S Abatement Systems Explored

Representatives of DOE's San Francisco Operations Office (SAN) met with MCR Geothermal to discuss costs and benefits of an entirely new H₂S abatement system developed by UOP, Inc. under DOE contract. Comparisons are being made between the UOP geothermal catalyst (GEOCAT) and the EIC copper sulfate (CUPRASIL) systems. MCR is exploring alternative systems and is considering working with UOP to field test GEOCAT. This system might be used for control of hydrogen sulfide from wells on bleed, required for future well drilling permits from the Lake County Air Pollution Control District, which controls power plants at The Geysers.

Source: DOE, 7/20/81.

III. REPORTS AND PUBLICATIONS

This section presents abstracts and references of significant reports of interest to members of the geothermal community. The information is obtained from the source listed with each entry.

• Geophysical Maps of the Cascade Range in Oregon

The Oregon Department of Geology and Mineral Industries has recently released three sets of maps in its Geological Map Series. The new maps are GMS-15, a gravity map covering the northern Cascades in Oregon from the Washington state line to Redmond, and GMS-16 (gravity) and GMS-17 (aeromagnetic) covering the southern Cascades in Oregon from Crater Lake to the California state line. The central Cascades have been covered by maps published by DOGAMI in 1978 as GMS-8 and GMS-9.

Available from: Oregon Department of Geology
and Mineral Industries
1005 State Office Building
Portland, Oregon 97201

Source: DOE-Region X Geothermal Energy Report, 5/81

• Geothermal Resources of the Eastern United States

The hydrothermal resources of the 35 states east of the Rocky Mountains (excluding the Dakotas) have been compiled by J.L. Renner and T.L. Vaught of Gruy Federal, Inc. The resource definition data was derived from the open literature and the files of a number of state geological offices. The report is entitled Geothermal Resources of the Eastern United States (DOE/NVO/1558-7) and costs \$5.25 for a paper copy and \$3.00 for microfiche.

Available from: NTIS
U.S. Department of Commerce
5285 Port Royal Road
Springfield, VA 22161

Source: Geothermal Energy, Vol. 9, No. 3, 3/81

• New Weekly Newsletter

Federal Lands is a new weekly newsletter published by McGraw Hill. It focuses on the development of fuels and nonfuel minerals on federal lands both on-shore and off-shore. For subscription information contact McGraw-Hill.

Available from: McGraw-Hill
Federal Lands
1221 Avenue of the Americas
New York, New York 10020
(212) 997-6410
(800) 223-6180 (Toll-free)

Source: Geothermal Energy, Vol. 9, No. 3, 3/81

• Advances in European Geothermal Research

The proceedings of the Second International Seminar on the Results of European Communities Geothermal Energy Research includes more than 70 papers dealing with regional and local exploration and exploitation of geothermal resources. Edited by A.S. Strub and P. Ungemach this volume contains about 1100 pages and costs \$63.

Available from: Kluwer Boston, Inc. (U.S./Canadian Distributor)
160 Old Derby Street
Hingham, MA 02043

Source: Geothermal Energy, Vol. 9, No. 1, 1/81

• Minerals Recovery Research

The results of a Bureau of Mines mineral recovery research program is reported in Well Engineering and Sampling Variables in the Evaluation of Geobrines by W.D. Riley and others. The results indicate the importance of the operating and engineering history, the operating parameters during sampling, and the method of sampling in order to evaluate the chemical analyses. This report (RI 8465) is distributed free of charge.

Available from: Section of Publications
Bureau of Mines
U.S. Department of the Interior
4800 Forbes Avenue
Pittsburgh, PA 15213

Source: Geothermal Energy, Vol. 9, No. 1, 1/81

• California Energy Almanac

The Office of Lieutenant Governor Mike Curb and the State Commission for Economic Development have published a list of more than 3100 "public and private entities in California which directly deal with energy and the environment." The cost of this 477 page volume, The California Energy Almanac, is \$10.

Available from: Office of the Lieutenant Governor
Room 1028
State Capitol
Sacramento, CA 95814

Source: Geothermal Energy, Vol. 9, No. 1, 1/81

• Reports Published by the University of Utah Research Institute

Periodically, the Earth Science Laboratory at UURI publishes reports and open file material generated under Department of Energy contracts. For a listing of current material contact:

Publications
Earth Science Laboratory
University of Utah Research Institute
420 Chipeta Way, Suite 120
Salt Lake City, Utah 84108
(801) 581-5283
FTS 588-5098

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IV. DIRECTORY

This section presents the names and addresses and/or phone numbers of individuals in the geothermal community, particularly the participants in the Geothermal Progress Monitor system.

DOE HEADQUARTERS

James Bresee
Acting Director,
Geothermal and Hydropower Technologies Division
Conservation and Renewable Energy
(202)252-5340

REGIONAL OFFICES

The DOE Regional Offices were closed on October 1, 1981. Their functions have been transferred to appropriate DOE Operations Offices.

OPERATIONS OFFICES

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Room 803, Rosslyn Plaza East
P.O. Box 2417
Washington, D.C. 20013
(703) 235-8010

Forest Service Regions

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Missoula, MT 59807
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11177 West 8th Avenue
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FTS 234-3905

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